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COVER PICTURE

Weeping willows combine with native eucalypts to produce this attractive scene near Greenbushes.

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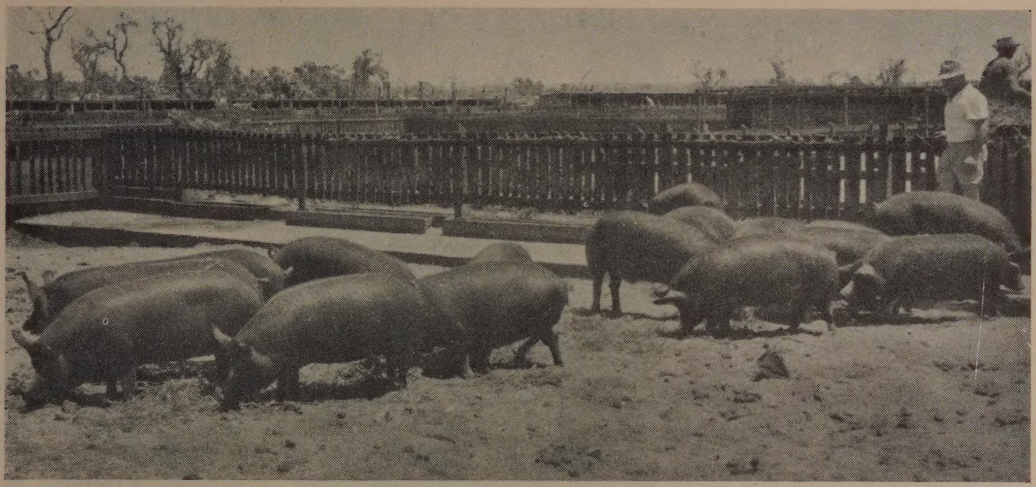


PROFITABLE PIG-FEEDING

The Importance of Protein

By K. M. HOPE, B.Sc. (Agric.), Agricultural Adviser

THE food consumed by pigs during their transition from weaners to marketable porkers or baconers is the biggest single item on the pig-raiser's list of costs, so it naturally follows that if we can reduce food costs while still maintaining carcass weight and quality there will be bigger margins of profit when the pigs are sold.

Food costs may be reduced effectively by feeding the right foods in the correct proportions. No other method can give the quick growth, coupled with good carcass quality, which is the aim of the efficient pig-raiser.

Correct feeding makes for good food conversion rates—in other words we get more pigmeat for each pound of food consumed—and it is obvious that a pig which puts on 1 lb. of liveweight for each 3 lb. of food consumed is a much better commercial proposition than one which eats 5 lb. of food to produce a similar liveweight gain.

Correct feeding helps pigs to grow quickly and to develop carcasses containing fat and lean meat in the proportions which the bacon-curers and the consumers of pigmeats find most acceptable.

THE PIG'S NUTRITIONAL NEEDS

A complete diet includes proteins, carbohydrates, fats, minerals and vitamins plus crude fibre and ample supplies of good water.

The bulk of the pig's diet is made up of crushed grain which is rich in carbohydrates and has adequate fibre and phosphorous. An animal protein supplement and the calcium supplement detailed later, provide the supplementary protein fats, minerals and vitamins which are needed to build up the basic grain ration into an efficient production food.

Proteins may be of animal or vegetable origin but supplies of animal protein are essential if pigs are to be reared successfully. Good sources of animal protein for pig-feeding are meatmeal, whalemeal, dried whale solubles and separated milk. Young green crops and pastures and leguminous plants such as peas and beans are the main sources of vegetable protein available in Australia.

In general terms, the proteins are utilised in building up muscle, nerves, bone and blood—in other words they pro-

mote rapid growth—so ample protein is needed when pigs are young so that they grow quickly and lay the foundation for the finished carcass.

The carbohydrates are the energy-producing and fat-forming constituents of the diet.

A BALANCED DIET

The best food conversion rates and the highest quality pigmeats with the desirable proportions of fat to lean, result from rations containing proteins and carbohydrates in the correct proportions.

Pigs which receive ample supplies of grain but are under-supplied with proteins will grow slowly. Apart from the fact that they will eat a lot of food to produce a small liveweight gain, the carcasses will be carrying too much fat and too little lean meat to realise top prices.

It is worth remembering, too, that while deficiencies in minerals and vitamins will usually result in obvious ill-health, pigs suffering from a deficiency of protein may appear healthy and continue to make some growth. It is only when they are marketed that their low carcass quality and poor food conversion rates become obvious.

PROTEIN LEVELS

Low Protein Means Slow Growth.

Remember always that it is the protein content of the feed that builds up bone and muscle. With this in mind it is easy to realise that young pigs need plenty of protein to enable them to develop rapidly.

They begin life on a protein-rich ration, for sow's milk contains over 30 per cent. protein (on a dry basis). From birth to three weeks of age the average pig increases from 3 lb. to 12 or 15 lb. in weight on its diet of sow's milk plus trace minerals preferably obtained by foraging in clean paddocks.

When they begin to chew dry feed at about the three-weeks stage, they should have a protein-rich mixture available at all times in a creep self-feeder which allows them to enter but keeps the sows out.

The feed mixture at this stage should be rich in protein (17 to 18 per cent.) and by the time the pigs are weaned at eight weeks of age they should weigh about 40 lb. each and be ideally prepared for rapid growth and early marketing.

As shown in the "Guide to Hand-Feeding," the pigs are fed on the 17 to 18 per cent. protein mixture until they reach

GUIDE TO HAND-FEEDING

Showing the approximate daily quantities of food required per pig when either separated milk or meatmeal, whalemeal, etc. are given as protein supplements (1½ gallons of separated milk being equivalent in protein content to 1 lb. of 50% meatmeal).

Age and Classification	Approximate liveweight	Protein Supplement		Carbohydrate food, crushed wheat or equivalent	Approximate overall percentage protein in total ration
		Separated milk	Meatmeal or equivalents (50% protein basis)		
	lb.	gal.	lb.	lb.	%
3–8 weeks sucker	12–40	creep-self-feeder ration			18
8–10 weeks weaner-slip	40–50	¾	½	1–2	18
10–14 weeks grower	50–80	¾	½	2–3	16
14–18 weeks light porker	80–110	¾	½	3–4	15
18–22 weeks heavy porker	110–140	¾	½	4–5	14
22–28 weeks light and medium baconer	140–200	¾	½	5–6	13
Heavy baconer	200 plus	¾	½	6	13
In-pig sows and boars	....	1½–2¼	1–1½	6–9	16
Sows and litters	....	3–4½	2–3	8–12	17–18

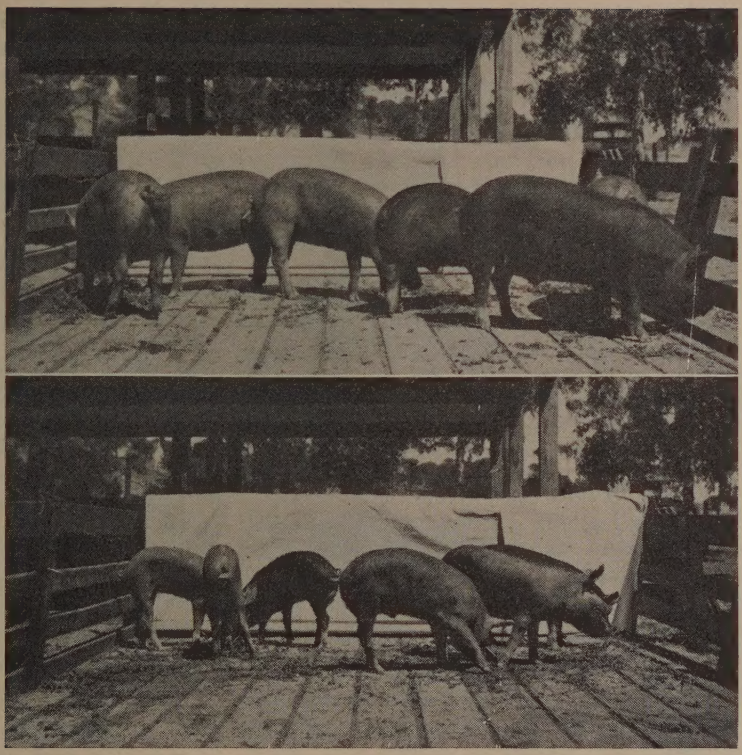


Fig. 1.—All the pigs shown in these two photographs started as weaners with an average liveweight of 40 lb. They were of similar breeding and all were six months old when the photographs were taken

Those in the top picture were fed on balanced rations of meatmeal and crushed grain. Those in the lower picture were fed on crushed grain alone

about 50 lb. liveweight, after which the protein level is progressively reduced.

A mineral supplement as described later should be fed in addition to the grain and meatmeal.

POINTS ON HAND-FEEDING

The feeding tables are prepared only as a general guide, although they have proved highly satisfactory in actual practice. It must be remembered that no feeding tables can completely replace the first-hand knowledge which the pig-raiser gains by observation of his stock.

In the case of in-pig sows, for instance, care must be taken to ensure that they do not become too fat. Over-fat sows often have difficulty in farrowing, are more liable to crush their piglets and seldom milk satisfactorily.

Boars and pregnant sows normally do well on a ration with 16 per cent. protein, or approximately the same level as that fed to growing pigs in the 50 to 80 lb. liveweight range.

Sows with litters should receive a mixture containing 17 to 18 per cent. protein because they must produce protein-rich milk for the piglets.

It will be seen by the table that a balanced ration can be provided by feeding a fixed quantity of protein supplement from weaning to marketing. In the case of 50% protein meatmeal, this would be about ½ lb. per pig per day with a gradual increasing quantity of grain.

A "rule of thumb" guide for feeding crushed wheat (or the equivalent in carbohydrate-rich foods) would be 1 lb. per pig per day for each month of age, with the rule only applied when weaning is completed and the daily intake of the slip has reached 2 lb. or more. This corresponds to about 1 lb. of grain per day for each 28 lb. of liveweight.

When hand-feeding baconers the grain ration should not exceed 6 lb. per pig per day and the protein level should never go below 13 per cent. or the food conver-

sion rates will suffer and more food will be needed to give the required liveweight gain.

SELF-FEEDING SAVES LABOUR

By putting out bulk supplies of ready-mixed feed in self-feeders, so that the pigs can help themselves at all times, considerable time is saved and one man can attend to a larger number of pigs.

For self-feeders it is customary to use only three grades of rations as shown below, in fact many pig-raisers use these grades when hand-feeding as they give results almost equal to those achieved by the gradual changes in the hand-feeding table. The three grades are as follows:—

1. High Protein (17-18%).

For sows suckling litters and from creep and weaner stages to 70 lb. liveweight (light porker).

15 lb. meatmeal, 100 lb. crushed grain 1 lb. limestone fines.

2. Medium Protein (15-16%).

For in-pig sows, boars and from light porker to 100 lb. liveweight (medium porker).

10 lb. meatmeal, 100 lb. crushed grain, 1 lb. limestone fines.

3. Low Protein (13%).

From medium porker to baconer weights.

5 lb. meatmeal, 100 lb. crushed grain, 1 lb. limestone fines.

The meatmeal referred to is that containing 50 per cent. protein. If the meatmeal or whalemeal used has a higher or lower protein content, the quantities will need to be reduced or increased accordingly.

When using self-feeders it is advisable to market pigs at slightly lower liveweights than those recommended for hand-feeding. This is because pigs on unrestricted feeding tend to lay on more fat. A modified self-feeding technique will allow pigs to be finished on a restricted ration, once they have grown rapidly to about 100 lb. liveweight. This requires a changeover from grains such as the wheat and barley to the more fibrous oats.

IT PAYS TO CRUSH THE GRAIN

All grain should be coarsely crushed for pigs as the improvement in utilisation far outweighs the cost of crushing.

Wheat at 10 to 12 per cent. protein content and 2 per cent. fibre is the most concentrated grain for pig-feeding.

Barley at 9 to 12 per cent. crude protein content and 5 to 6 per cent. fibre is suitable for pig-feeding and can be used successfully for all classes of pigs.

Oats at 9 to 11 per cent. crude protein and 9 to 12 per cent. fibre are too fibrous for young pigs but are ideally suited for in-pig sows, boars and for finishing baconers on self-feeders. The fibre limits the intake by these pigs and prevents them becoming overfat.

Mixed grains are also very palatable to pigs, but young pigs up to 100 lb. liveweight should not receive more than 25 per cent. oats in their crushed grain ration or growth will be slowed down.

As a guide to budgeting, 60 lb. of wheat can be replaced by 66 lb. barley or 75 lb. of oats.

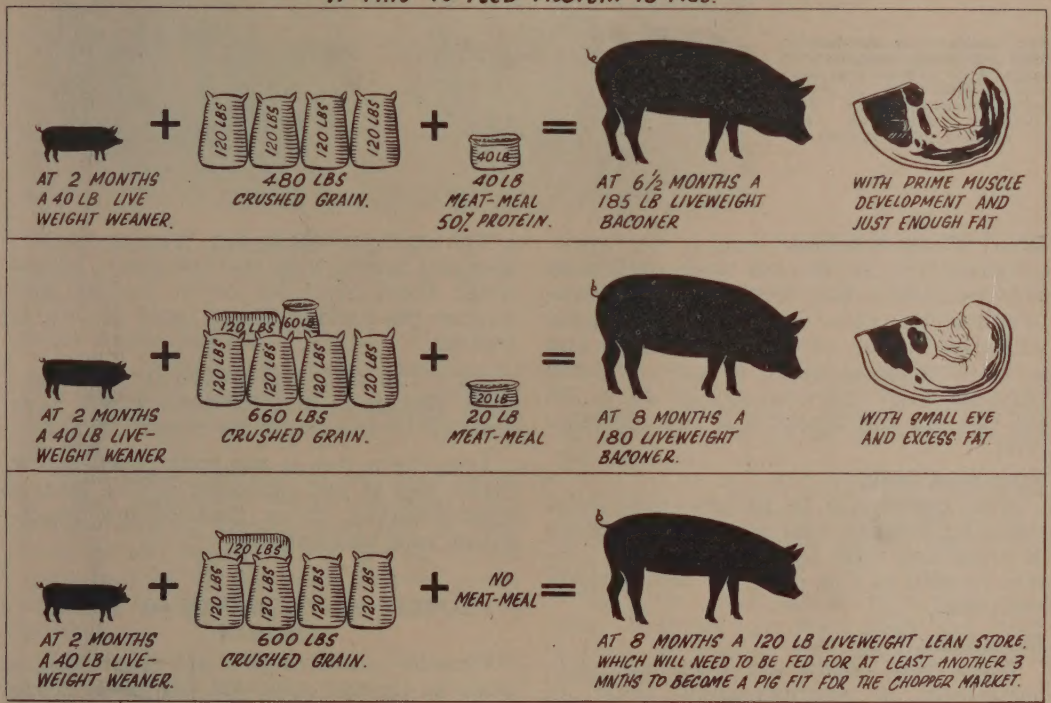
MINERAL SUPPLEMENTS

Salt at ½ lb. per 100 lb. of crushed grain, and ground limestone at 1 lb. per 100 lb. of crushed grain would normally be the only mineral supplement required by most pigs, as cereal grains are rich in phosphorus. Where pigs receive a gallon or more of separated milk they should not require ground limestone as the milk is rich in calcium (lime). If the water supply contains more than 100 grains of salt to the gallon, a salt supplement will not be necessary.

Copper deficiency can cause leg weakness in pigs, but may be prevented by grazing the animals in paddocks which have been topdressed with a bag to the acre of copperised superphosphate. One top-dressing should suffice for seven or eight years.

Where pigs are sty-fed in the wheatbelt, it would be advisable to feed the following mineral supplement at the rate of ½ lb. to 100 lb. of grain:

Dissolve 8 oz. of copper sulphate (bluestone) and 2 oz. of zinc sulphate in two pints of hot water. Sprinkle the solution over 100 lb. of salt and mix thoroughly.


AT 2 MONTHS A 40 LB LIVE WEIGHT WEANER.
480 LBS CRUSHED GRAIN.
40 LB MEAT-MEAL 50% PROTEIN.
AT 6½ MONTHS A 185 LB LIVEWEIGHT BACONER
WITH PRIME MUSCLE DEVELOPMENT AND JUST ENOUGH FAT
AT 2 MONTHS A 40 LB LIVE-WEIGHT WEANER
660 LBS CRUSHED GRAIN.
20 LB MEAT-MEAL
AT 8 MONTHS A 180 LIVEWEIGHT BACONER.
WITH SMALL EYE AND EXCESS FAT.
AT 2 MONTHS A 40 LB LIVE-WEIGHT WEANER.
600 LBS CRUSHED GRAIN.
NO MEAT-MEAL
AT 8 MONTHS A 120 LB LIVEWEIGHT LEAN STORE. WHICH WILL NEED TO BE FED FOR AT LEAST ANOTHER 3 MNTHS TO BECOME A PIG FIT FOR THE CHOPPER MARKET.

Sow's milk is naturally low in iron and copper and cannot be improved by feeding extra iron and copper to the sow. A deficiency in the young pigs may be prevented by allowing them to run out on clean pasture or by giving them a fresh clod of earth from clean ground each day. Alternatively, the udder of the sow may be sprayed with an iron, copper and sugar solution. If the in-pig sow's mineral intake is satisfactory, the iron and copper reserves in the liver of the new-born piglet should be high enough to avoid trouble as long as they can run out on clean ground.

ANIMAL PROTEIN NECESSARY

With the pig, part of the protein must be of animal origin or growth will suffer. Animal protein contains Vitamin B12 and related substances which are together called the Animal Protein Factor (A.P.F.). These substances do not occur in plant protein.

When the protein supplements are meatmeal, skim milk, etc., there would be no difficulty with animal protein shortages as a couple of ounces (dry weight) each day, would provide enough A.P.F. for good growth in pigs. If only a couple of ounces of animal protein is fed per pig per day, the balance must be made up with vegetable protein as growth will not be satisfactory if overall protein is insufficient.

PROTEIN SUPPLEMENTS OF ANIMAL ORIGIN

Meatmeal.

Midland Junction meatmeal is registered as 50 per cent. minimum crude protein with others down to 27 per cent. crude protein. The amount fed would be regulated according to the protein content from analyses and biological value as revealed by growth of the pigs.

Whalemeal.

Various brands are registered from 62 per cent. minimum crude protein to 53 per cent. minimum. It may be fed to completely replace meatmeal on a proportionate basis.

Fig. 2.—Bacon cuts showing good muscle development with large "eye" of lean meat and correct proportion of fat to lean resulting from well-balanced meatmeal and crushed grain rations

Dried Whale Solubles.

Registered as 82 per cent. minimum crude protein. The feeding value is approximately equal to meatmeal and whalemeal on a protein unit basis, and would need the addition of approximately two pounds of bonemeal per 100 lb. to lift the calcium and phosphorus to a desirable level.

Separated Milk.

This contains 9 to 10 per cent. total solids on average analyses, and 1½ gallons of separated milk are equivalent in protein content to 1 lb. of 50 per cent. protein meatmeal.

Buttermilk.

When total solids are 9-10 per cent., buttermilk is approximately equal to separated milk, gallon for gallon. If it has been diluted with washing water and the total solids reduced to 5-6 per cent., then two gallons would be required to replace 1 gallon of separated milk.

Whey.

Undiluted whey contains between 6 and 7 per cent. dry matter. This dry matter contains approximately 15 per cent. protein, which is principally albuminous as the casein has been extracted in the cheese-making process. Pigs from weaning to 70 lb. should receive normal meatmeal supplements, and from 70 lb. to 100 lb. half the normal meatmeal supplement in addition to the grain and whey. Pigs 100 lb. and over can grow well on crushed grain and whey plus the mineral supplements.

Dried Separated Milk and Dried Buttermilk Powders.

Typical analyses show 32 to 34 per cent. crude protein. This milk protein is usually of better quality than that contained in meatmeal, enabling the milk powders to replace meatmeal on a pound for pound basis.

The milk powders are very palatable, alone or mixed with crushed grain, which make them ideal for creep feeding and weaner pig rations where rapid growth is desired.

They are also well-suited for a short-term change in diet for sows which have gone off their feed for no apparent reason.

Long-term use of the milk powders for other pigs is not economic as the cost is approximately twice that of the meatmeals and whalemeals.

PROTEIN SUPPLEMENTS OF PLANT ORIGIN

Protein concentrates of plant origin such as linseed meal (30 per cent. crude protein) are normally scarce and highly-priced on a protein unit basis. Oil-extracted cottonseed meals, soya-bean meals, groundnut (peanut) meals and similar products are not available here although much used overseas. Field peas and similar legume seed crops can supply all the protein, save for the small amount of animal protein needed to supply A.P.F. and the pig can harvest them itself.

On a practical basis, actively-growing green pasture or crops would be the main economic source of plant protein in Western Australia.

Apart from protein, the greatest value of green crops or green pasture is as a source of Vitamin A. Vitamin A is essential for normal reproduction in pigs and if no greenfeed is available a Vitamin "A" supplement should be supplied to breeding pigs.

As a source of protein, young green pasture is very satisfactory, but because of its bulk, it could not be expected to supply any more than half of the protein supplement, even when unlimited in supply.

Fig. 3.—Small eye muscle with a lot of fat and very little lean—the result of low protein levels

Dry grazing should be regarded as of negligible value to pigs and a complete ration fed.

Dried Brewer's Yeast.

Typical analyses of dried brewer's yeast give a protein content of 42 per cent. but its value is limited by its low palatability to pigs.

Yeast could replace up to one-quarter of the meatmeal ration without any serious loss of palatability and on this basis its cost would need to be slightly less than that of 50 per cent. protein meatmeal to make it a payable source of protein.

There is no justification for paying high prices for brewer's yeast as a source of Vitamin B. The recommended meatmeal and crushed grain rations—with or without green grazing—are not deficient in the B Vitamins.

ANTIBIOTICS AND APPETITE PROMOTERS

The antibiotics, procaine penicillin, aureomycin and terramycin all act as appetite promoters; boosting the daily intake of feed and thus the daily gain. In approximately 50 per cent. of trials, the antibiotic improved feed conversion sufficiently to cover its own cost.

When feed cost is a major consideration, be sure that other limiting factors such as protein intake are not reducing growth rates and feed conversion to unsatisfactory levels. Meatmeal or equivalents should be bought and used at recommended levels before investing in growth promoters.

Fast unrestricted growth from birth to market is ideal for economy of feed conversion on normal rations. This can be obtained by good rations to healthy stock in good clean paddocks and pens. It is therefore recommended that the antibiotics be saved for any particularly backward groups and not used over all pigs as a general practice.

DON'T FEED WORMS

Always remember that worm-infested pigs cannot thrive, no matter how well they are fed.

Admittedly, the well-fed pigs suffer less ill-effects from worm infestation but it is obviously a bad policy to buy costly feed to nourish parasites.

De-worm your young pigs one week after weaning and keep down the worm burden by resting the grazing paddocks under crop.

WATCH THOSE GROWTH RATES

The pig-raiser who has to wait up to four or five months to get a return from his porkers, or six to seven months to rear a baconer, should keep a careful check on his growth rates.

In the case of a producer of eggs or milk, any fall in the protein content or the general quality of the feed is almost immediately reflected in the daily production and can be rectified without delay, but unless the pig-raiser pays careful attention to the growth rates and frequently checks the time which elapses between farrowing dates and marketing, he could be feeding his pigs uneconomically for long periods without realising the fact.

That is where a good set of scales could be helpful, both for checking the quantities of feed consumed and for keeping the pig-raiser informed of the liveweight gains which the feed is producing.

In the hand-feeding sphere, excellent results of 3.1 lb. to 3.6 lb. of total feed per 1 lb. liveweight gain have often been re-

corded, with rapid weight increases and good carcass quality.

A 3.6 lb. conversion rate would mean that to grow from 40 lb. to 180 lb. liveweight, a pig would consume 520 lb. of feed consisting of 480 lb. of crushed grain and 40 lb. of meatmeal (50 per cent. protein).

As the diagram shows, the reduction of the meatmeal intake to 20 lb. meant that to produce the same liveweight the pig would need to consume a further 180 lb. of grain (680 lb. of total feed) and even then the carcass would be of lower quality with too much fat and a smaller eye muscle.

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Selecting and Preparing Table Poultry

By R. VAGG, Poultry Instructor,
and M. W. G. CRITCHELL, Poultry Inspector

Fig. 1.—Dislocating the neck

THE two main classes of poultry used for table purposes in Western Australia are "roasting fowls," which are usually young cockerels or capons and "boiling fowls," which are mainly hens that have passed their most productive laying periods. The distinction is not an arbitrary one, as the so-called boiling fowls—if cooked slowly—can be roasted quite successfully and are preferred by many people. In addition to the two main classes, there is a growing demand for younger, smaller birds for frying and for barbecue meals.

The bulk of the table birds used are from two main heavy breeds—Australorp and Rhode Island Red—or the lighter but quicker-growing First Cross birds from White Leghorn-Australorp matings. The First-Cross males are popular as "roasters" at the 12 to 14-week-old stage.

Fig. 2.—Remove the wing and tail feathers first

The age at which birds should be killed for roasting, will depend largely upon the weight of carcass required. A 12 to 14-week-old male bird should have a live-weight of about 3 lb., and one 20 weeks old will be about 5 lb. liveweight. The dressed weight is usually from two-thirds to three-quarters of the liveweight, so that birds of 3 lb. and 5 lb. liveweight should dress out at approximately 2 lb. and 3½ lb. respectively.

CHOOSING A SUITABLE BIRD

The ideal table bird is the capon—a male bird that has been surgically de-sexed. Birds so treated may be fed to heavy weights without losing the tender-ness and delicate flavour usually associ-ated with younger and lighter birds, but caponising by surgical operation has never become popular in Australia owing to the restricted market for high-priced table poultry.

A popular alternative is the chemically-caponised bird—often referred to as a "caponette." The caponette is a young male bird in which the normal secretions of the male sex glands have been neutralised. This is achieved by implanting a pellet containing synthetic female sex

Fig. 3.—Strip off the feathers from the back and sides of the bird with a rubbing motion towards breast and tail

hormones under the skin of the neck. These hormones are gradually absorbed into the system and temporarily produce similar results to surgical caponising—a distribution of fat through the muscular tissues, with improved flesh and skin texture.

If purchasing cockerels, make sure that the birds are young. The shanks should be smooth and no spurs should have developed, as the appearance of spurs indicates that the bird has reached an age when the texture and flavour of its flesh has commenced to deteriorate.

In a young bird, the bone structure is soft and pliable. The end of the breast-bone, in particular, should be more of the nature of cartilage—springy and flexible under pressure.

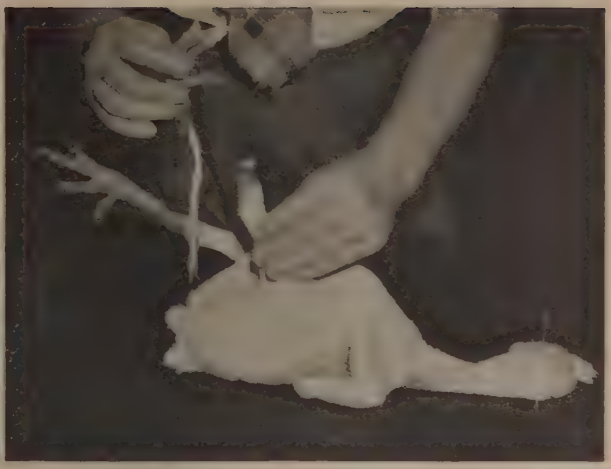
KILLING

Food should be withheld from the birds for about 24 hours prior to killing, but adequate supplies of clean water should always be available.

This ensures that the alimentary tract will be empty and makes for cleaner dressing with better-flavoured flesh.

Fig. 4.—One side plucked clean

Fig. 5.—Plucking completed



Figs. 6 and 7.— Drawing the sinews from the legs. After making a light cut encircling the shanks about an inch below the hock joints, the legs are broken by firm pressure against the edge of the table. A strong steady pull will draw out the sinews as shown on the right

Dislocation of the neck—if expertly performed—is probably the best method of killing a bird. It is quick and clean and does not involve spattering the clothes of the operator with blood—which usually occurs when the axe and chopping block are used.

Fig. 1 shows how the bird is held. The left hand holds the legs and the right hand (if the operator is right handed) is placed on the neck with the thumb to the rear and the fingers forward. With the bird held head downward against the outside of the operator's right thigh, a quick downward pull with a simultaneous anticlockwise twist of the wrist will break the neck. The thumb (not visible in photograph) presses upward under the beak as the fingers press downward, so that as the pull is completed the hand turns and finishes with the little finger upward and the palm turned outward to the right.

The neck and blood vessels should break cleanly and the bird should be held for about a minute so that the blood can drain into the cavity caused by the dislocation.

REMOVING THE FEATHERS

Most home poultry-dressers will find that plucking is facilitated if the bird is first dipped into sufficient hot water to cover the carcass.

The ideal temperature of the water will vary according to the type of bird being treated, but it should be between 145° F. and 212° F. (boiling point). For most birds, the rule-of-thumb method of three parts of boiling water to one part of cold will give good results.

The bird should be immersed for about 30 seconds (in the case of cockerels or capons) or about 40 seconds for a boiling fowl, and it should be rotated so that the water penetrates to the skin.

Remove the bird from the hot water and, if too hot to handle comfortably, give a quick dip in cold water. Start by remov-

Fig. 8.—A cut is made across the back of the neck and then the skin is slit towards the head, freeing the neck—

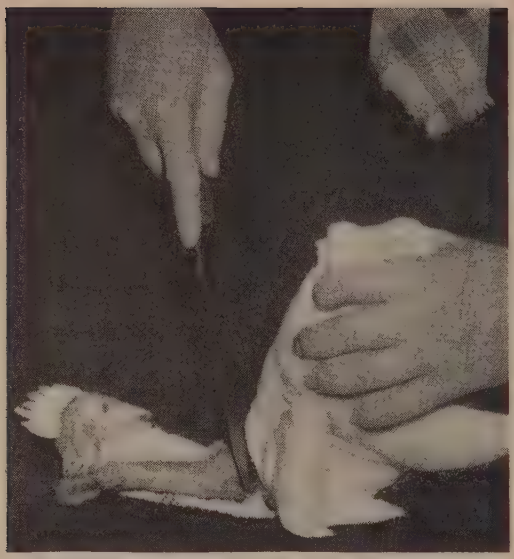


Fig. 9—which is then cut off close to the body

ing the wing and tail feathers, which should pull out readily if the bird has been correctly dipped. (See Figs. 2 to 5.)

Next, lay the bird on its side with the head towards the operator. Place the hand almost flat on the upper part of the body and remove the feathers with a rubbing motion towards the breast and tail. Repeat on the other side and the back.

Pin-feathers may be removed by rubbing with a handful of loose feathers.

Special care should be exercised in plucking cockerels and capons as their skin and flesh will tear readily. Older birds can withstand rougher handling.

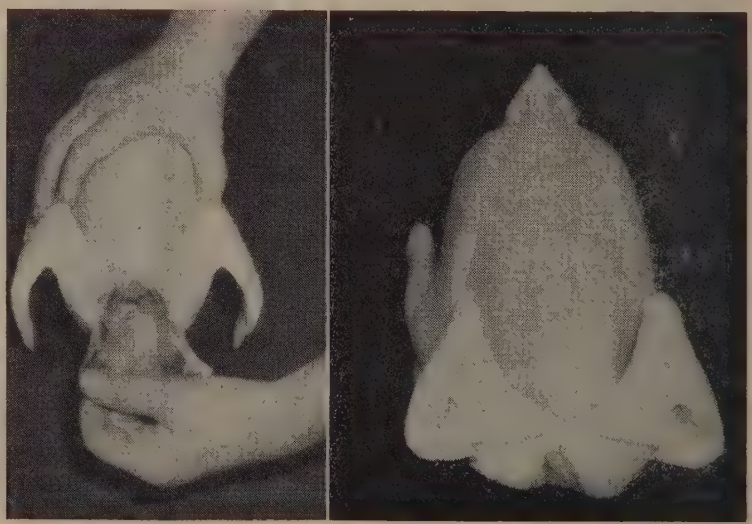
DRESSING

The first step in preparing a fowl for the table should be to draw the sinews from the legs as shown in Figs 6 and 7. This greatly improves the eating quality of the "drumstick" portion.

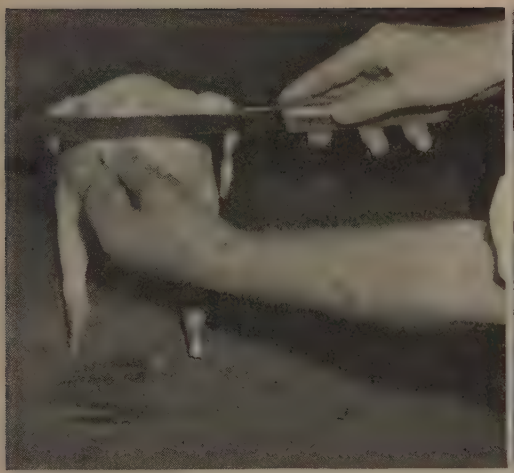
The next stage is to make a cut across the skin of the neck near the body and then slit the skin towards the head, running the knife under the skin along the back of the neck (Fig. 8). The neck is cut off close to the body (Fig. 9) and the head is removed, leaving a flap of skin which is used to cover the aperture. After severing the head and neck the crop may be removed (Fig. 10) and the internal organs loosened with the fingers.

The flap of loose skin is folded over the hole and held in position by folding the wings inward then outward over the back and shoulders (Fig. 11).

Next cut between the vent and the "parson's nose" and then make a knife-cut encircling the vent so that it is freed from all surrounding attachments (Figs.



Figs. 10 and 11.—The crop is removed through the neck opening and a flap of skin is folded over the aperture where it is held in position by the wings which are twisted to fold over the back



Figs. 12 and 13.—A cut is made between the vent and the tail (left) and continued round so as to free the vent—

12 and 13). Insert the fingers into the body cavity and loosen the entrails then withdraw them with a strong steady pull (Fig. 14.)

This should leave the body cavity empty except for the lungs which will be found closely adhering to the back portion of the bird, well forward towards the shoulders. Pressure with the tips of the fingers inside the body cavity will loosen the lungs and care should be taken to remove them cleanly as the lung tissue decomposes readily in warm weather.

The carcass should be wiped with a damp cloth both inside and out, but should not be washed as excess moisture encourages decomposition.

To truss the bird for the oven, pass a length of strong white cord round the "parson's nose" and tie securely leaving two long ends (Fig 15). The ends are passed round the hock joints, then crossed under the legs, passed round the "parson's nose" again and pulled tight before tying. (Fig. 16.)

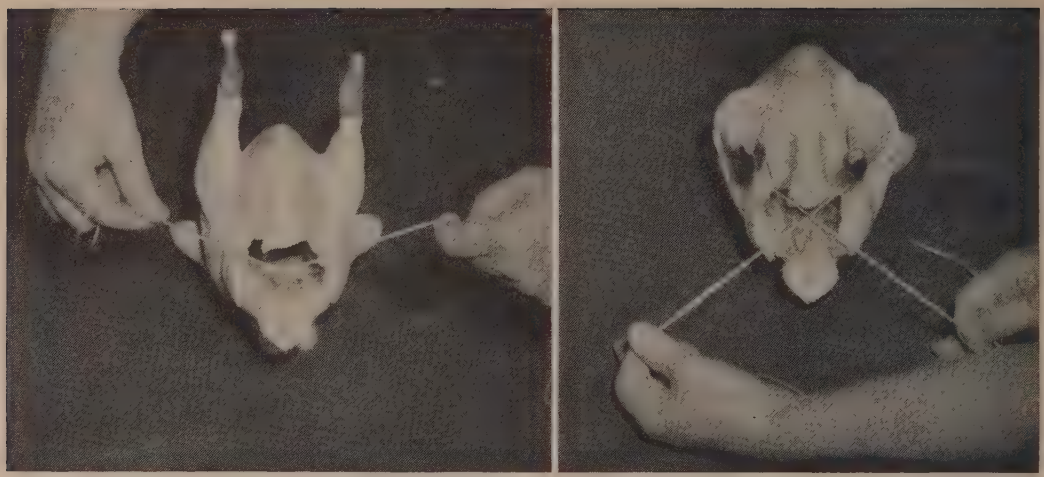
To give a neater appearance to the carcass, some people remove the stumps of the shanks before trussing. When the legs are cut off at the hock joints however, the meat is liable to slip away from the bones in cooking leaving the "drumstick" bones partially exposed.

The neck, gizzard, heart, liver and shanks may be retained for soup-making. The gizzard is opened and the yellow lining peels away freely. The legs should be dipped in boiling water for a few seconds after which the outer skin and claws may be removed easily.

DRESSING DUCKS

Ducks and geese have feathers which shed water readily due to the secretions from special oil glands. Because of this the plucking of these birds presents some difficulties and water temperatures and scalding periods are important.

Fig. 14—after which the entrails are removed by a steady pull



Figs. 15 and 16.—Trussing. The cord is passed round the "parson's nose" and tied. The ends are then passed round the shanks and crossed above and below the tail, after which they are drawn tight and tied

Killing by neck dislocation is difficult in the case of water-fowl, and beheading with the axe is the method usually adopted. Hold the bird firmly by the legs and wing-tips, lay the head and neck on a wooden block and sever the head by a blow from a sharp axe or hatchet.

Ducks are very strong and care should be taken to avoid injury from their sharp claws in the reflex action which occurs after the head is cut off. When movement has ceased and bleeding is completed, the bird should be dipped in water, heated to about 120° F., in which a tablespoonful of any good detergent has been added to each gallon of water. Move the bird around in this water for about a minute until the plumage is thoroughly wetted.

Next dip the bird in water (without detergent) heated to about 180° F. and proceed with the plucking, dipping quickly in and out of cold water first, and then removing the wing and tail feathers as recommended previously.

Waterfowl grow and replace their downy feathers about every 14 days and the plucking is best performed when the pin-feathers are well-developed—between the 7 and 14-day growth period.

PREPARED POULTRY PACKS

It may not be generally known that in addition to supplying dressed carcasses of various weights and classes, commercial poulterers in Perth put up special cellophane packs of chicken portions such as drumsticks, thighs, wings and breasts.

Special soup-making packs are available, also "fryers" in whole or half chicken packs.

Most of the packs carry advice on the cooking of the contents.

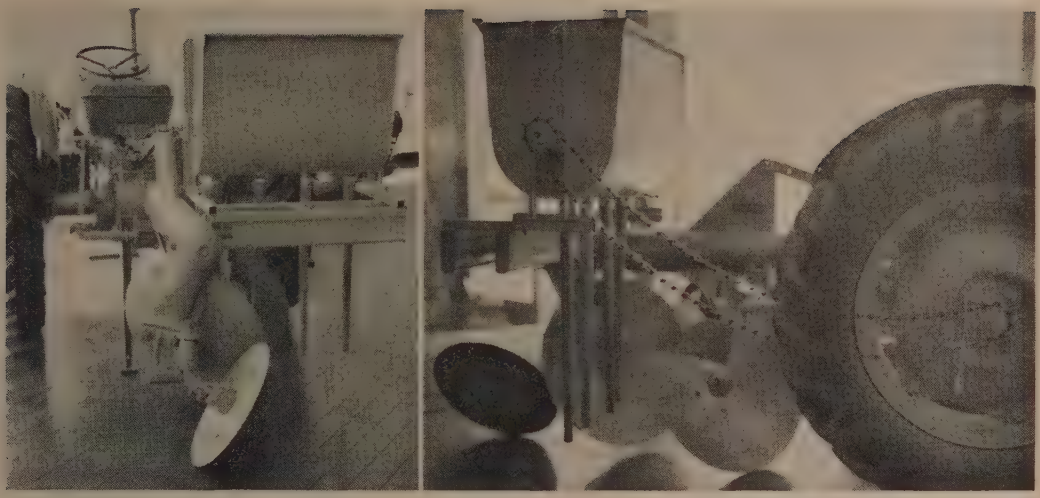


Fig. 1.—Two views of the seed-box attached to a Ferguson tractor with two-furrow disc plough

A SEED-BOX FOR SOWING BUFFEL AND BIRDWOOD GRASS SEED

By K. FITZGERALD, B.Sc. (Agric.), Adviser, North-West Branch

A MAJOR drawback to the more widespread use of Buffel grass, Birdwood grass and Kapok bush for reseeding our eaten-out and denuded pastoral areas has been the absence of a seed-box capable of handling this type of seed. Officers of the North-West Branch of the Department of Agriculture have now designed, built and tested a simple yet effective seed-box capable of handling either class of seed, or a combination of the three, with equal facility. It makes possible the cultivation and reseeding in the one operation, with provision for regulating the seeding rate to practically any desired level.

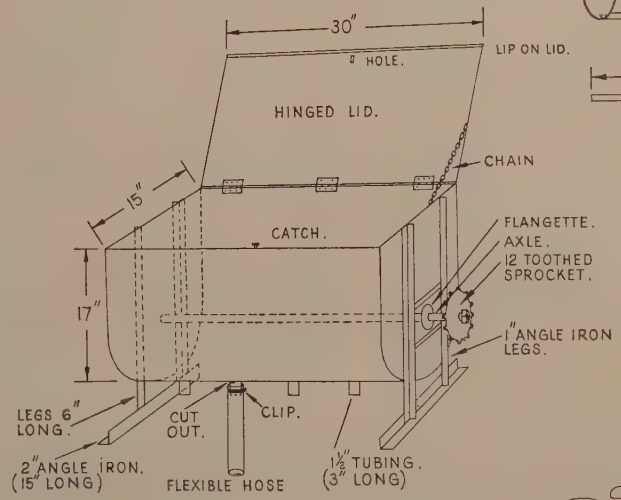
Buffel grass has proved particularly difficult to sow through a conventional seed-box owing to its light, fluffy nature and the presence of hairs or bristles which cause it to "clump" together over the stars or feeding mechanism without going through the outlets. The same applies to Kapok bush seed and to a lesser degree with Birdwood grass.

This has been overcome by fitting a series of beaters inside the box so that they revolve within a quarter of an inch of the inside of the box, keeping the seed agitated to prevent "clumping" and at the same time forcing it out through the outlet holes.

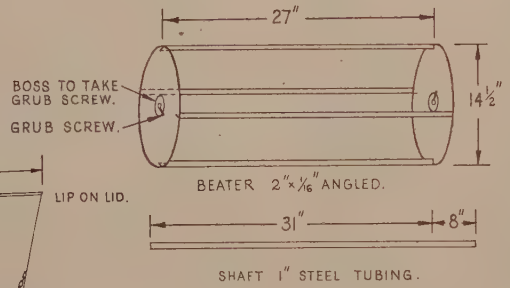
The bottom of the box has been curved to accommodate the beaters and to eliminate "dead corners" where the seed might lodge, while the top is rectangular to facilitate refilling and to increase the capacity. A hinged lid is fitted to prevent loss of seed while the box is in operation.

Efforts have been made to keep the weight down to a minimum. The overall weight of the completed unit is about 90 lb. so it can be readily handled by one man.

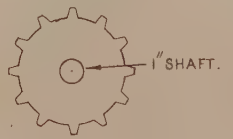
SEED. BOX.



BEATER UNIT.



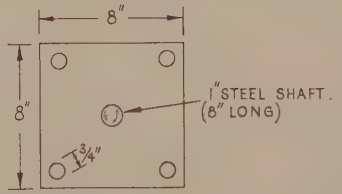
12 TOOTHED SPROCKET 6" IN DIAMETER.

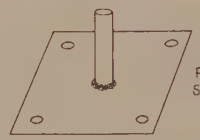


CUT OUT.

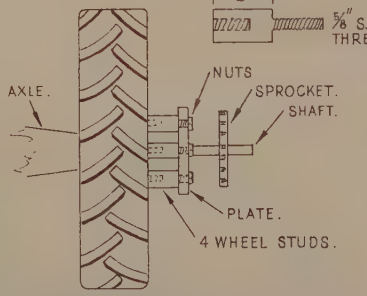
ENLARGED SECTION SHOWING THREE POSITIONS. – OPEN – HALF OPEN – AND – SHUT.

WHEEL ATTACHMENT.





WHEEL STUD.



REAR TRACTOR WHEEL.

Sixteen-gauge flat galvanised iron was used in the construction of the box; this gives ample strenth with light weight. Box dimensions are as follows:—

	in.
Overall length	30
Height—without legs	17
Width	15

The lid is hinged at the two rear corners and with a half-inch lip at the front edge makes a snug fit. A thumbscrew catch is provided to secure the lid.

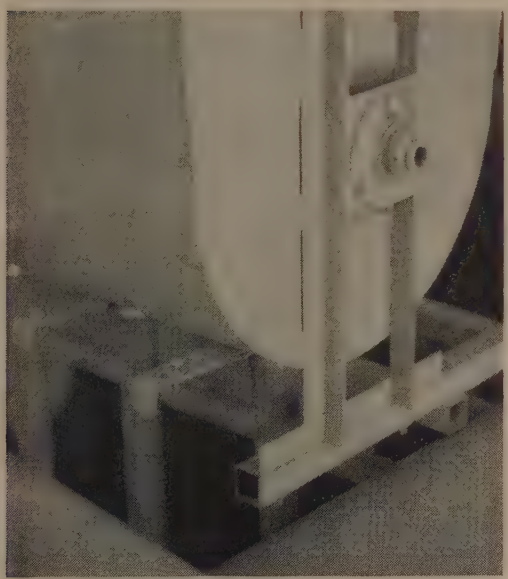


Fig. 2.—Showing cut-off attachment

Strength with lightness has also been the keynote in the construction of the beaters. The shaft or axle is of 1 in. steel tubing while the beaters are of 16-gauge plate 2 inches wide and angled for strength. The four beaters are welded at both ends to flat discs which are in turn attached to the shaft by mean of grub-screws. With this set-up it is easy to take the beater system apart if required. The overall length of the beater unit is 27 in.

The beater unit runs in pre-packed, self-aligning bearings or flangettes. These are particularly useful under dusty conditions and where rough ground would throw added strain on the beater shaft and bearings. They also eliminate the need for grease nipples which can be a nuisance with light seed such as Buffel grass.

The flangettes, which carry the beaters, are bolted externally to two pieces of 1 in. angle-iron welded to the end of the box for added strength and stability, in addition to serving as the legs of the unit. To complete the set-up, a short length of 1½ in. angle-iron is fitted at either end to the legs of the box; a series of holes have been drilled along this so that the box can be attached to practically any type of tractor-drawn or tractor-operated implement.

Outlet holes have been drilled along the middle line of the bottom of the box. Normally four half-inch or five-eighths-inch holes will be adequate but both the number and size can be varied at will. With half-inch holes and a four-bladed beater the seeding rate with mixed Buffel, Birdwood and Kapok seed has been calculated at about five seeds per inch or roughly 1 lb. seed per mile of furrow. This is with the cut-offs adjusted to leave all four holes fully open. Where clean Birdwood seed is used it would be wasteful to have all holes fully open.

Short lengths of 1½ in. steel tubing have been welded over the outlet holes. This makes possible the fitting of rubber or flexible hoses to carry the seed down close to the ground so as to reduce the tendency for the seed to be blown away from the furrows under windy conditions. The steel tubing has been slotted at the top to accommodate a cut-off device by which the seeding rate can be regulated. Only three positions have been provided in the prototype—fully open—half open—fully closed, but, by drilling extra holes a wider range could be obtained.

When used in conjunction with the cut-out device the flexible hoses make possible a wide range of row spacings.

The seed-box is chain-driven with a sprocket on the shaft of the beaters and another attached to the rear tractor wheel. Ordinary No. 52 agricultural chain works quite well and is easy to fit and adjust. The rear wheel attachment is simple: a piece of flat steel plate ¼ in. thick and about 8 in. square has a piece of 1 in. steel tubing welded to its centre;

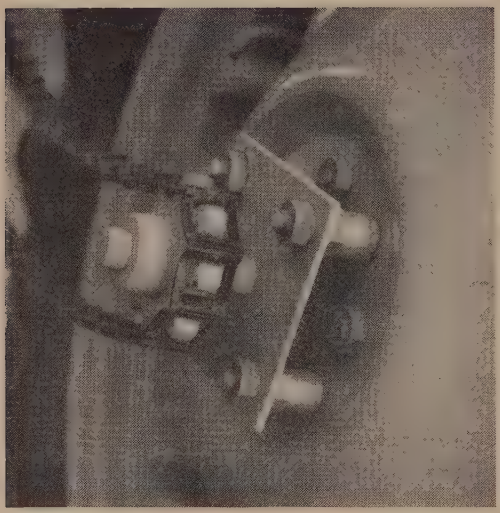


Fig. 3.—Showing method of attaching drive sprocket to rear wheel of tractor

this tubing serves as an axle to carry the driving sprocket and need only be 8 in. long. Four $\frac{3}{4}$ in. holes are drilled in the steel plate to coincide with four of the tractor wheel studs and after fitting 2 in. extension nuts to the studs the plate is slipped over the studs and secured with the wheel nuts. The plate then operates as an integral part of the tractor.

A range of sprockets is available for fitting on to either the tractor wheel or the seeder making possible further regulation of the seeding rate. The demonstration model has a one-to-one drive, using a 12-toothed sprocket.

As mentioned earlier, the cultivation and reseeding may be done in the one operation by attaching the seeder to any desired implement. A suitable attachment has been made for the disc plough but fittings for other implements are easily made.

Best results are obtained by positioning the seeder above the implement so that the seed falls on to broken ground and is covered lightly. It is inadvisable to have the seed covered to a greater depth than one inch.

This seed-box has been particularly successful when used in conjunction with a three-point linkage and hydraulic system where the machine can be lifted out of the ground when the going gets too rough. Road transport is also facilitated, although in this case it is advisable to remove the chain drive before engaging the road gear.

With the three-point linkage system, care must be taken to ensure that the chain is fairly slack when operating, otherwise it is likely to break or stretch when lifted out of the ground. A "jockey pulley" has been incorporated to take up the slack when operating.

Although the seeder has been designed primarily for use with tractor-operated or tractor-drawn implements it could readily be fitted on the back of a jeep, truck or even a spring-cart. The drive then would be very similar to the old-time rabbit-poisoning cart.

Box capacity is about 15 lb. of clean seed or sufficient for about 15 miles of furrows. In terms of working time this is about three and a half to four hours, as second-gear operation or about 4 m.p.h. is preferred when ploughing and seeding so as to reduce wear and tear on both machines.

The use of this simple but effective seed-box could greatly increase the scope of reseeding operations in our northern pastoral areas.

The seed-box is now being manufactured commercially, and is available in Perth, at a cost of approximately £65 complete.

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MOLYBDENUM POISONING OF STOCK

By P. B. LEWIS, Veterinary Surgeon

MOLYBDENUM has been found beneficial in parts of the State used as a fertiliser constituent for pasture. It is only needed in small quantities and should not be used at a greater rate or more frequently than is recommended.

Excess molybdenum in the feed may affect cattle, sheep and goats. Foals nursed on mares fed on high molybdenum diets have shown signs of poisoning.

Broadly speaking the element has the effect of depressing the ability of an animal to use copper in the feed, and also appears to cause the movement of the element phosphorus from the bones causing rarefication and weakening of them.

Various symptoms have been ascribed to molybdenum poisoning and may vary from unexplained poor performance, particularly of young stock, to severer conditions with scouring, emaciation, weakness, painful joints, etc.

Other effects described have been:—

(1) Change of the normal gait of mature animals to a "pacing" gait. Both legs of the same side of the animal move forward together. This is painful to the animal.

(2) Ends of the long bones, particularly of young animals, are enlarged, resembling rickets.

(3) In older animals the weakening of the bones causes a tendency to frequent fractures.

(4) There appears to be a tendency for an increase in the percentage of abnormal calves born. These may be premature (7 to 8 months).

(5) In severe poisoning, sterility occurs in both males and females, and apparently this is permanent in the case of the bull. In the case of the female there is a failure to come into season which can be corrected by copper supplements.

(6) In some cases sudden death due to heart failure has been blamed on excess molybdenum causing a copper deficiency.

FREE SERVICE TO FARMERS

Do you know that the Department of Agriculture provides a comprehensive service of advice and technical assistance to farmers, free of charge?

When in need of advice, get in touch with your District Officer whose name and headquarters township will be found in the list of Departmental personnel on Pages 266 and 267.

These officers are there to help you and will make personal visits to your property to assist with on-the-spot advice. In addition, they will, where necessary, arrange for the services of specialist officers—all without cost to you.

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PRICKLY PEAR

(*Opuntia* sp.)

In 1925 it was estimated that 60 million acres of pastoral land in Queensland and New South Wales were affected with prickly pear. On half of this area the growth was so dense that the land had no productive value. An amazing transformation was brought about by the introduction of the Cactoblastis insect.

WEEDS of Western Australia

By **G.R.W. MEADLY** M. Sc.
Officer in Charge, Weeds and Seeds Branch

PRICKLY PEAR

(*Opuntia* spp.)

THE prickly pears are native to America, but, following settlement of that country by the white man, have been introduced to many other parts of the world. Besides presenting a problem in their natural habitat, their increase to the extent of becoming serious weeds has occurred in South Africa, India, Ceylon, Madagascar and Australia. The spread of prickly pears has been due to three main reasons—firstly the establishment of the cochineal industry, secondly the edible nature of the fruit and thirdly the curious form of the plants along with their attractive flowers, which have encouraged their cultivation as garden subjects.

Until synthetic dyes were developed, the cochineal industry flourished in many places, notably the Canary Islands, and various types of cactus were introduced to a number of countries with a view to providing food for the cochineal insects. In Mexico and other Latin-American countries certain kinds of prickly pear are cultivated for their fruits which represent a staple article of diet. So important is the plant to the natives of South Madagascar that fear has been expressed that its destruction may cause starvation among the natives.

Various species of *Opuntia*, as well as other cacti, are frequently sold as ornamental plants in many countries including Australia. The first introduction of prickly pear to Australia was due to the desire to establish the cochineal industry. It is recorded that plants and insects were brought to Port Jackson from Rio de Janeiro in 1787 by Captain Arthur Phillip. This prickly pear was undoubtedly the smooth or drooping tree pear (*O. monacantha*), a troublesome plant but not one of the two main pest species, *O. inermis* and *O. stricta* which have never been recorded from Brazil. Governor Phillip is often unjustly blamed for the initiation of Australia's prickly pear problem. With the exception of *O. monacantha* the method of introduction of the prickly pears is not known with any degree of certainty. It is significant, however, that the important species occur in the immediate vicinity of trade ports of consequence—Galveston in Texas, Valparaiso in Chile and Montevideo in Uruguay. It is likely that their botanical curiosity prompted their introduction.

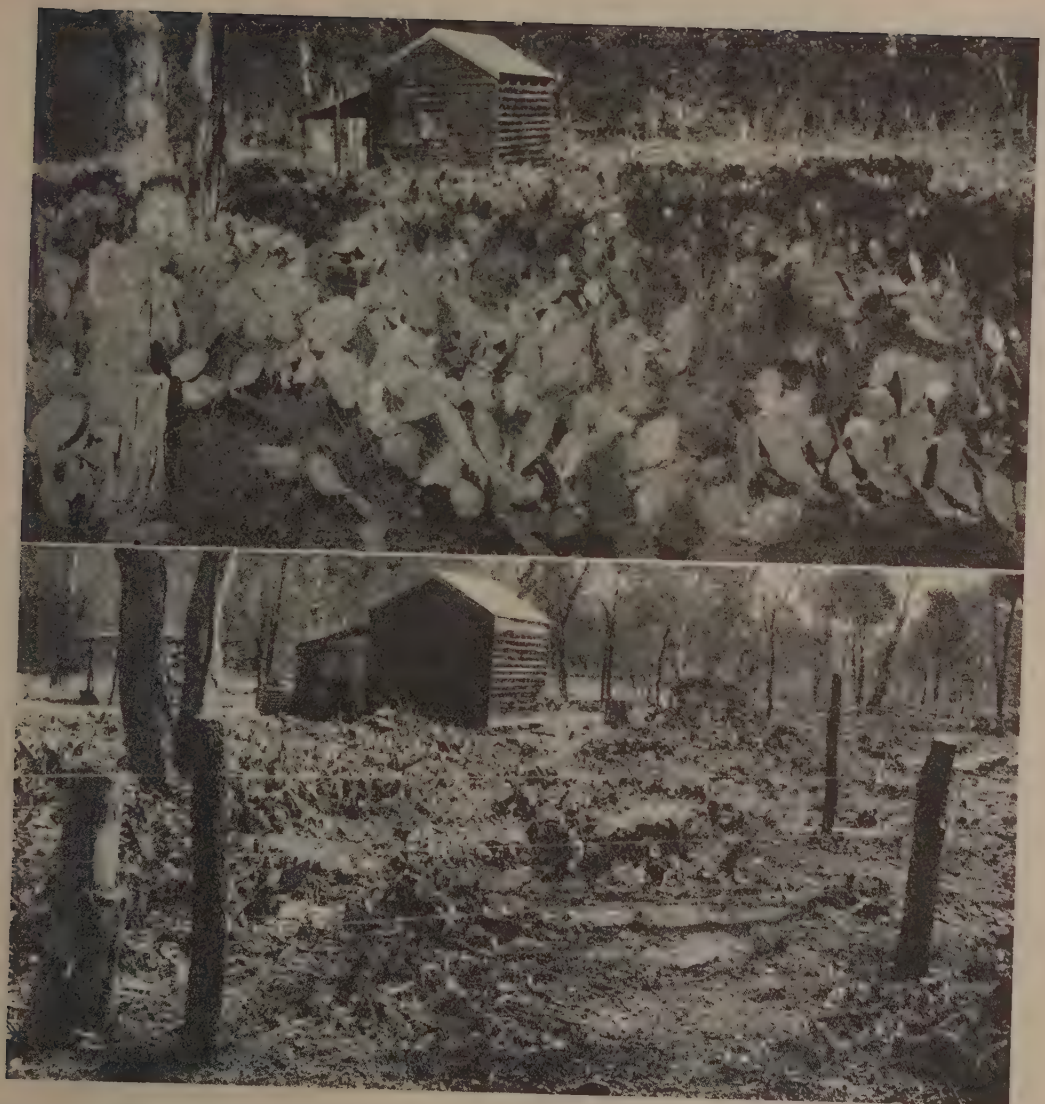
DESCRIPTION

The name, prickly pear is self-explanatory. The fruit itself has the shape of a pear and those acquainted with the plant need no introduction to the prickles. Besides the species already mentioned, two others have caused concern in Queensland. They are the velvety tree pear (*O. tomentosa*), a large and tree-like plant and the tiger pear (*O. aurantiaca*), a low, much-branched and exceptionally spiny type.

The shrub pears—those having the greatest economic significance in Australia—have a more or less upright, shrubby growth, branching from near the ground,

PRICKLY PEAR.

A branch of Prickly Pear *(Opuntia* spp.) together with a typical flower and young fruit.



The top picture shows portion of an abandoned selection at Chinchilla, Queensland, in May, 1928, when the prickly pear had over-run the property. The lower photograph was taken in October, 1929, when the cactoblastis moth had destroyed the pear

without a definite trunk and attaining a height of 3-10 feet.

The characteristic feature of prickly pears is that the stems contain chlorophyll and function as leaves. These flattened stems are known as cladodes or segments. The true leaves take the form of short stiff bracts and soon fall off. The flowers are 1 in. to 3 in. across and are brightly coloured, ranging from bright yellow, orange and red to pink. The fruits are succulent, more or less pear-shaped. They are produced in large numbers and contain many hard-coated seeds which remain viable for a number of years.

SIGNIFICANCE

The problem of prickly pear in Australia can be stated briefly as that of a vigorous, rapidly-spreading weed occupying very

large tracts of grazing country where mechanical and chemical methods of eradication were economically impracticable as the cost of treatment exceeded the value of the land.

The two main pest pears obtained their footing in Australia when pastoral holdings were very large and the population was sparse. From the time of the turn of the century they spread very rapidly until the peak of the invasion was reached in 1925. At that time about 60 million acres were affected, half of which comprised infestations which were so dense that the land had no productive value. More than 80 per cent of the area was in Queensland, the remainder being in New South Wales. Fortunately Western Australia was not involved.

The pear territory has an annual rainfall of 20-30 inches and comprises good grazing land suitable for dairying and general farming. In the peak years the pest spread at an alarming rate and year by year more properties were engulfed.

Isolated patches of prickly pear occur in Western Australia but nowhere in this State has it become a problem, although conditions in parts of the north appear to be favourable for its growth. For this reason the plant has been declared a primary noxious weed for that portion of the State North of the 26° of latitude.

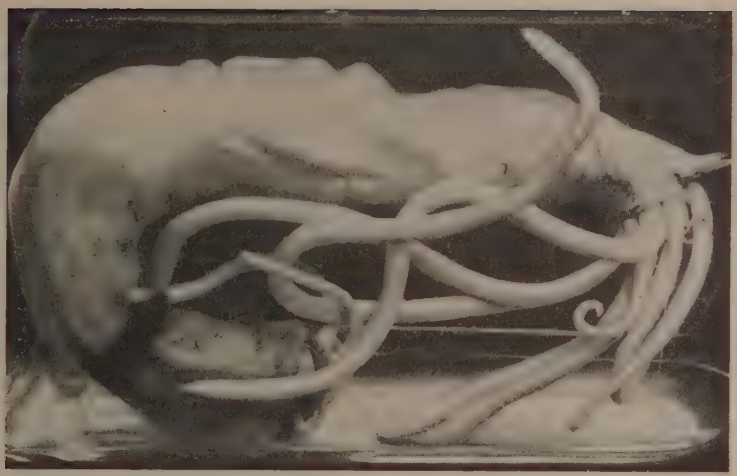
Attention is now being given to an infestation at Cossack, near Roebourne, where the plants have tended to spread in recent years. A liking for the fruit has prompted some people particularly market gardeners and vignerons near the metropolitan area, to grow a few plants. In some districts this has caused concern as the fruits or pears are attacked by fruit fly. Mainly for this reason prickly pear has been declared a noxious weed in some districts to enable destruction to be enforced if necessary.

CONTROL

The suppression of prickly pear is the most outstanding achievement of biological weed destruction, imported insects having brought most of the species under control in Queensland and New South Wales. The common pest pear has been largely eliminated by the grub of the Cactoblastis moth, drooping pear is kept in check by the Indian cochineal, tiger pear by Argentine cochineal and velvety tree pear to a certain extent by the Mexican cochineal.

The progress of these insects, particularly the Cactoblastis has been spectacular, great tracts of country previously made useless by the presence of prickly pear having been transformed to prosperous farming districts. The larvae are gregarious and, by tunnelling into the segments and stems, reduce the plants to a rotting mass. South America was partly responsible for providing Australia with the pest but was also the origin of some of the natural enemies which have been of inestimable value to this country. It is very fortunate that these insects are selective as far as their host plants are concerned and do not move to other plants after the prickly pear has been destroyed.

Plants can be destroyed by grubbing but no portion of the plant should be permitted to remain in contact with the soil as this enables rooting to take place. Spraying with arsenical solutions such as arsenic pentoxide is also effective.



This photograph shows portion of the small intestine of a pig tightly packed with large roundworms. Treatment with sodium fluoride or piperazine would have removed most, if not all, of the parasites

WORMS IN PIGS

By F. C. WILKINSON, B.V.Sc., Veterinary Surgeon

THE large roundworm (Ascaris lumbricoides) is the only one of the 16 known worm parasites of pigs that has any serious effects upon the pig industry in this State. This parasite is widely spread in most of the areas where pig-raising is practised, and is the cause of much of the stunted growth seen in young pigs, as well as some deaths.

These roundworms are usually found in the small intestine and generally average six to ten inches in length. They are creamy-white in colour, cylindrical in shape, tapering to a point at both ends.

Some idea of the damaging effects of worm infestation upon the growth of young pigs may be gathered from experimental evidence which showed that for each roundworm found in a pig's intestines at five months of age, the pig weighed at least 1 lb. less than its litter mates which were kept worm-free.

LIFE-CYCLE

The life-cycle is quite complicated but interesting and of more than just academic interest, because from an understanding of the life-cycle comes the realisation of the cause of much of the damage by the parasite and the basis of the all-important control programme.

The adult female worm is a prolific egg layer and may produce up to 200,000 eggs daily. These are microscopic in size and are passed on to the ground in the droppings of the pig. The eggs once on the ground, develop to an infective stage in ten days or longer, depending on how suitable the conditions are. Eggs developing or at the stage of containing an infective larva, are extremely resistant to varying climatic conditions and may remain alive for several years. If however, they are exposed to direct sunlight under hot dry conditions, then they are unlikely to survive for more than a few weeks.

The infective eggs, that is those with a larval parasite coiled up within the shell, do not develop further until they are swallowed by a pig. In older pigs they are taken up in the food or water, whilst in the case of young pigs, they are usually sucked from the teats of the sow during feeding. Upon reaching the small intestine of the pig, the eggs hatch and the larvae are set free. They burrow into the wall of the intestine and reach the blood vessels where they are carried in the blood stream to the liver, and then through the

heart to the lungs, where they escape into the air sacs of the lung and undergo further growth and development. After about 7 to 23 days from the time of infestation, the larvae migrate up the trachea (windpipe), are swallowed, and pass once again to the small intestine. This time they remain and grow to maturity in eight to nine weeks.

Important points to be drawn from the life history are—

(1) The enormous number of eggs produced by the mature female worm.

(2) The eggs once on the ground are not infective until ten days have elapsed.

(3) The extreme resistance of the eggs in the surroundings of a pig sty, where they may remain infective for years.

(4) The damage to the liver and more especially the lungs by the migrating larvae.

SYMPTOMS

The symptoms depend on the severity of infection and the age of the pigs. Older animals can harbour large numbers of worms yet they rarely suffer any ill-effects. In new-born pigs which become heavily infected, they develop what is commonly referred to as "thumps." They go "off colour," pant violently, crawl into dark places and commonly die within a week of being infected.

Weaners may tolerate fairly heavy lung infections, as long as they are well fed and warmly housed, but if the conditions should suddenly deteriorate, secondary infection with bacteria can lead to a severe outbreak of pneumonia with much coughing, and possibly severe mortality. In addition, if the infective agent of virus pneumonia is present in the herd, it will cause more damage in those lungs where the larvae of roundworms are present, than in those which are free of larvae.

In young pigs harbouring the adult worm in their intestines, growth of the pig is seriously impaired. They remain stunted and unthrifty, while the coat is rough, and the pig has a pot-bellied appearance.

DIAGNOSIS

When the presence of roundworms is suspected, the diagnosis may be confirmed by the slaughter and post-mortem examination of an animal showing typical symptoms. The worms will be found in the small intestine (runners) which extends from the stomach to the caecum ("blind gut"). This portion of the intestine should be freed from its attachments and opened with scissors. The parasites, when present, will not be overlooked on account of their large size. Occasionally, worms which have wandered from their natural site in the small intestine may be found in the stomach or in the bile ducts of the liver.

Both liver and lungs may show evidence of the injury inflicted by the larval worms during their migration. The surface of the liver may show the presence of whitish areas about ¼ in. in diameter which are popularly known as "milk spots." The lungs may show more or less extensive solid pneumonic areas which contrast sharply with the spongy normal lung tissue which surrounds them.

When a post-mortem examination cannot be performed, a diagnosis can usually be established by examination (in the laboratory), of a sample of the droppings for the presence of worm eggs.

TREATMENT

Two extremely efficient drugs, sodium fluoride and piperazine, are available for the removal of the adult worms from the intestines of the infected pigs. No drugs however, are available to kill the larvae of the parasite during their migratory phase through the liver and lungs.

Sodium Fluoride.—When sodium fluoride is employed according to the following dose rates and mixed as prescribed, obeying the precautions noted, it is very efficient and cheap to use.

DOSE RATES

Live Weight of Pigs. lb.	Number of Pigs to 1 oz. of Sodium Fluoride.
20	14
21–40	7
41–60	4
61–80	3
81–100	2–1/3rd
101–150	2
151–200	1½
over 200	5/6ths

Prior to treatment, the pigs should be graded into small groups (up to ten animals) of even size, and the amount of sodium fluoride to be administered in their feed computed on a weight basis by reference to the above table.

This should be accurately weighed and thoroughly mixed in an amount of food which will be consumed during the course of the day.

An allowance of one pound of the treated food mixture per 25 lb. liveweight will be found adequate.

On this basis, seven weaners averaging 35 lb. would receive one ounce of sodium fluoride in about 10 lb. of food material. This amount will usually be consumed during the day, but should any remain uneaten it should be mixed with the evening feed. The drug will be taken readily in a mixture of crushed wheat and meat meal, which should always be fed dry, but any other meal mixture will be found equally satisfactory. It should never be given with wet mash or as a drench, as toxic effects are liable to follow.

In the treatment of large pigs, sows and boars, the dose of sodium fluoride should be divided, half being given in the morning, and the balance in the evening. In the case of such animals the food is often consumed rapidly, and the ingestion of a full dose of sodium fluoride in a short space of time may provoke violent vomiting. This does not occur when the dose is divided.

It is usual to starve the pigs overnight (allowing no food on the previous evening) prior to treatment, but this procedure is probably unnecessary.

Following treatment, worms do not usually make their appearance in the droppings for two to three days, and may continue to be passed out until the eighth or ninth day.

The efficiency of sodium fluoride for the expulsion of round worms from the small intestine of the pig is of a high order. In the treatment of small groups of pigs experimentally, it frequently reaches 100 per cent. and under field conditions, it can usually be relied upon to expel 85 to 90 per cent. of the parasites.

When the drug is given in medicinal doses, apart from the passage of soft faeces and mild vomiting in a few cases, no ill-effects need be expected. Amongst large numbers of pigs included in field trials no deaths resulting from treatment have been recorded. The gradual consumption of the treated food apparently provides an adequate safeguard against the toxic effects of sodium fluoride, and in addition should an excessive amount of the drug be consumed, vomiting is induced, so providing a further safeguard.

The evidence now available indicates that sodium fluoride, when given in the recommended dosage is a safe and highly effective drug for the treatment of worms in pigs.

Piperazine.—Piperazine is manufactured in many different forms by various manufacturers. The dosage varies with the form of piperazine and so varies with the different proprietary lines. The dosage however for the most efficient treatment in each case, is clearly written in the instructions.

Advantages of piperazine are that:—

(1) It has a very low toxicity and is free from side-effects such as vomiting.
(2) It may be given in wet or dry feed or in the water.
(3) Fasting before or purging after treatment is not required.
(4) The drug is very palatable and readily eaten by the pig.

One important point when administering piperazine is that for maximum efficiency, the drug should be given in a small amount of food or water so that it is consumed over a period of only two to three hours. Worms can be seen in the droppings about 24 hours after administering the drug.

Other drugs which have been used such as santonin, oil of chenopodium and phenothiazine are far less efficient than sodium fluoride or piperazine and should definitely not be used.

In general, it will be found necessary only to treat weaners and slips and this should be practised as a routine procedure on properties where infection is known to exist. The treatment should be carried out in a temporary enclosure and the pigs should then be transferred to fresh grouhd within ten days of treatment and before any eggs passed by them can become infective.

PREVENTION AND CONTROL

Due to the large number of eggs produced by the adult female worm and the long life of these eggs under the normal condition found around a pig sty, the soil soon becomes heavily contaminated with infective worm eggs. Consequently young pigs, which are highly suspectible, are exposed to infection from the time of birth. While treatment will remove the adult worms from the intestine it can have no effect on the larval stages of the worm which seriously damage the lungs and liver during their migration. Thus the important preventive measures are those concerned with the protection of young pigs from birth. A very satisfactory system is known as the MacLean County System.

The following procedure is adopted— The sow is treated with piperazine or sodium fluoride before farrowing. A few days before the farrowing is due to occur, the floor and walls of the farrowing pen are thoroughly cleansed by washing with a boiling 5 per cent. lysol solution (8 oz. to the gallon of water) applied with a hard broom. Immediately before being placed in the farrowing pen the sow is washed with a warm solution of soap and water, all mud and litter being removed; particular attention being paid to cleansing of the udder and teats. This will remove any worm eggs which may be adhering to the body of the animal. Within ten days of farrowing, the sow and her litter are carted to a clean field or a field which has been sown with a green crop and has not been occupied by pigs within the past year.

Under this system, young pigs may be carried to the age of four or five months without becoming seriously affected. Thereafter the animals, which are no longer highly susceptible may be transferred to yards for fattening.

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MINERAL FOOD SUPPLEMENT

INSECT Pests AND THEIR CONTROL

By C. F. H. JENKINS, M.A., Government Entomologist

PASTURE COCKCHAFERS

PASTURE damage due to cockchafer beetles has been recorded in parts of the South-West and Great Southern for the past 50 years, but it is only in the last few seasons that the pest has assumed serious proportions. The first really disturbing reports of pasture cockchafer activity came from the Kojonup district in the winter of 1955, and inspections showed that the insect was common from Boyup Brook to Katanning and down as far as Mt. Barker.

The first sign of cockchafer damage is revealed by the discolouration and final death of the crop or pasture. An inspection of affected areas will show that the ground is quite spongy and that the turf can easily be turned over, due to the root injury caused by a cockchafer grubs. In many instances, magpies and crows take advantage of this condition and congregate in large numbers to dig over the grub-infested ground.

Fig. 1.—Typical cockchafer beetle

Fig. 2.—Cockchafer grub

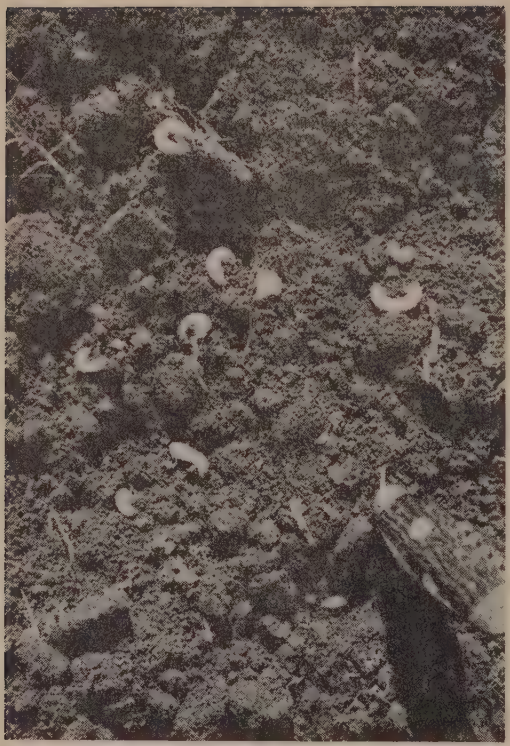

Fig. 3.—Cockchafer grubs revealed by digging

It is the immature stage of the cockchafer which causes all the damage and the grubs are variously referred to as pasture grubs, curl grubs and white grubs.

There are many different species of cockchafers or scarab beetles in Australia but fortunately most of them are of little or no economic importance. The majority are moderate-sized rather robust beetles and they often fly clumsily around the lights on summer evenings.

Since 1955 the pasture grub problem has been given considerable attention but unfortunately no satisfactory solution to the trouble has been found.

Two, and possibly three, species of cockchafers may be involved, and as they have different breeding habits and overlap in their distribution, only the most detailed study can clarify the situation. What we may refer to as the Kojonup cockchafer is a large brown beetle which was flying, and presumably egg-laying in the winter of 1956, a few days after phenomenal snow-falls were recorded in the South-West.

A smaller but otherwise comparable cockchafer was noted flying in midsummer as far apart as Albany and Bolgart. The small species has so far proved less troublesome than the larger variety but does the same type of damage.

It is worthy of note that the local pasture grubs differ considerably from the common species in Victoria and South Australia. In the latter a lindane-superphosphate mixture has given excellent control of grub damage but comparable treatments here have been quite useless. This is explained by the fact that the Eastern States insects come to the surface at night and so make contact with

Fig. 4.—Dark patches on the hill slope indicate oat crop destroyed by cockchafter grubs

any insecticide which may be present. The local varieties are completely subterranean and have so far defied chemical applications. Dressings of up to 4 lb. of dieldrin and 16 lb. of DDT per acre have only killed a few grubs and even if effective would of course be quite uneconomic at such high dosages.

The larger and most important of the two pest cockchafers has a two-year life-cycle and this accounts for the occurrence of damage in alternative years in some situations.

With arrival of summer, the grubs gradually descend as the soil dries out and finally remain dormant perhaps 15 or more inches down in hard dry soil.

So far, insecticides have only been applied to well-developed grubs and this may account for the poor results. Experiments are planned for the current autumn which will involve the application of insecticides to clover paddocks either just before or just after the beetles commence egg-laying.

Newly-hatched grubs may be much more vulnerable to insecticides than the older individuals and may succumb to dosages which would be economic to apply.

Clean summer fallow is the only cultural method which is known to have any controlling effect on the beetles, but in many areas the loss of feed resulting from such a practice would be more serious than that caused by the insects themselves.

In view of the very spasmodic occurrence of cockchafer damage and the scattered nature of the outbreaks it may be some time before the factors influencing the beetle activity can be clearly defined. In the meantime farmers will be rendering a service if they report the occurrence of the pest, and where possible forward specimens to the Department of Agriculture.

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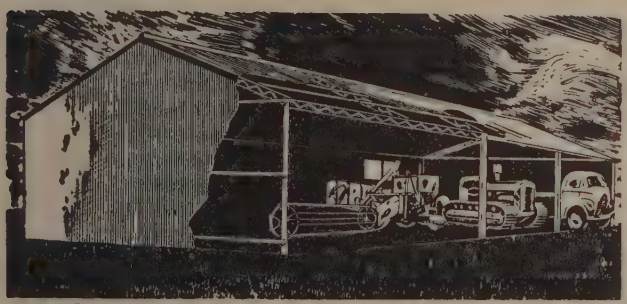

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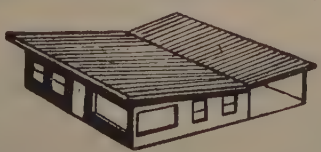

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Fig. 1.—Cultivation machinery has had to turn where the fence crosses the gully (bare area at right). The corner has washed out. If the fence followed the original gully, there would be no hazard

FARM PLANNING

3.—Natural Cultivation Boundaries

By B. a'B. MARSH, B.Sc. (Agric.), Adviser, Soil Conservation Service

IN Western Australian wheatbelt farming areas, cereal growing and stock grazing occur together; these two activities cannot go together without fencing, and the average farm may have 15 to 25 miles of internal fencing if it is adequately fenced. Usually these fences are not planned with any relation to the slopes or natural features. Farms are divided into many sections by a large mileage of natural features, such as creeks, gullies, rocky ridges and salty land, and also by a large mileage of fencing.

All these boundaries, natural and otherwise, cause erosion in many ways. Tracks and firebreaks usually follow such boundaries in preference to cutting across cultivated ground. If the tracks and firebreaks are not constructed properly, erosion can result. Fences and natural boundaries cause cultivating machines to turn corners and these corners are frequently an erosion hazard (see Fig. 1).

If natural and man-made barriers to cultivation have no logical relationship, contour practices are difficult to use in many of the small, odd-shaped, pieces of land. Erosion becomes more likely and if it occurs it becomes difficult to control. The erosion on a farm is fairly directly affected by the total length of cultivation boundary, as is also the degree of inconvenience encountered by the farmer. **The cure is no more difficult than designing most fences so that they follow natural boundaries.** Not all natural boundaries can be used, but the idea forms a sound basis for planning, and such planning can be made less time consuming and certainly much easier.

Natural boundaries can be defined as permanent features of the landscape which form an obstacle to cultivation. If these boundaries are extensive enough, they can be regarded as possible fence lines. The several types of natural boundary are listed and described overleaf:—

1. **Rocky Ridges.**—These are usually gravelly ironstone, often too steep or too rocky to permit cultivation. In some parts of the State, long, narrow bands of dolerite (sometimes called diorite) occur; these are associated with heavy red soil with large, rounded boulders. These strips are often straight. Granite outcrops are often small and scattered and do not obstruct cultivation unless they occur in broken lines. Large areas of rocky granite country also obstruct cultivation and are often worth fencing around to form separate pasture paddocks.

2. **Creeks.**—These are watercourses which carry water from large catchments. Usually they have not been cultivated because they are uncrossable; in some cases where they have been cultivated, this has led to inevitable gullying and such creeks are now uncrossable. Fences along creeks do not interfere with cultivation.

3. **Gullies.**—Some gullies can be healed, and if protected from running water, can be safely cultivated across. These are not classed as cultivation boundaries. Only those gullies which could not be protected in this way are regarded as boundaries. Some knowledge of the required soil erosion control work is necessary before planning some fences.

4. **Uneroded Depressions.**—Many gullies in the wheatbelt have been caused by cultivation of depressions followed by removal of the loosened soil by running water. Most gullies would not exist if farmers had avoided cultivating the depressions and hollows. Even though most farmers do not realise that they still carry out this unwise practice, there are still some depressions which have not yet eroded. This can be attributed not to the good sense of the farmer, but to the possibility that each time the uneroded depression has been cultivated, rains have not been heavy enough to cause water to run.

Uneroded depressions then, are not obvious cultivation boundaries but should be regarded as such if they cannot be protected from running water. Fences should be taken along close to these depressions, not so much to keep the fences out of the way, but to make it obvious to the driver of a tractor that these are cultivation boundaries.

If a fence so placed is for other reasons illogical, some other means of marking the depression should be used, for example, tree planting.

5. **Salt Land.**—It is of course, possible to cultivate across the boundary of a salt area, but it will seldom do much good. Salt land often benefits from cultivation, but usually from cultivation at a different time to land nearby, being cropped. Salt land is a boundary to cultivation and

Fig. 2.—Fencing along a watercourse, as illustrated here, does not interfere with cultivation and contour practices

fences around such land will not interfere with cultivation. In the same way extensive boggy or swampy areas or lakes can be regarded as cultivation boundaries.

6. **Sandy Country.**—It is often convenient to cultivate light and heavy country at different times. If the area of light land is very small it is not convenient, but if the area is sufficiently large, the boundary between heavy and light land should be regarded as a cultivation boundary.

7. **Trees or Shade Belts.**—Blocks of trees left for shade in otherwise cultivable ground come in this category. These can be regarded as cultivation boundaries. Where the trees are situated badly with respect to a satisfactory plan, their eventual removal should be contemplated and alternative trees planted in a more suitable place.

8. **Natural Paddocks.**—With no fences, a farm is divided into natural sections by the many types of natural boundary; these sections are called natural paddocks. Natural paddocks are seldom completely enclosed by cultivation boundaries and they vary in size. If many of the internal fences are placed along the natural boundaries, these fences do not interfere with most farm practices (see Fig. 2). To complete the farm plan, other fence lines have to be used. These fences can be placed so that they interfere least with cultivation, and fit in with water supplies, access tracks, and erosion control work. There is usually sufficient latitude to arrange the fences so that they enclose paddocks of fairly uniform area.

Planning fences by using natural cultivation boundaries is nearly automatic and it is difficult to make mistakes which might be regretted in the future.

FLOCK TESTING SERVICE FOR STUDBREEDERS

The Director of Agriculture (Mr. G. K. Baron Hay) stated recently that a flock-testing service for Merino stud breeders had been introduced by the Department and commenced in March this year.

This service has been commenced in order that Western Australian breeders may apply the principles of fleece measurement in their flocks and use these measurements to further improve their sheep for the ultimate benefit of the wool growing industry as a whole.

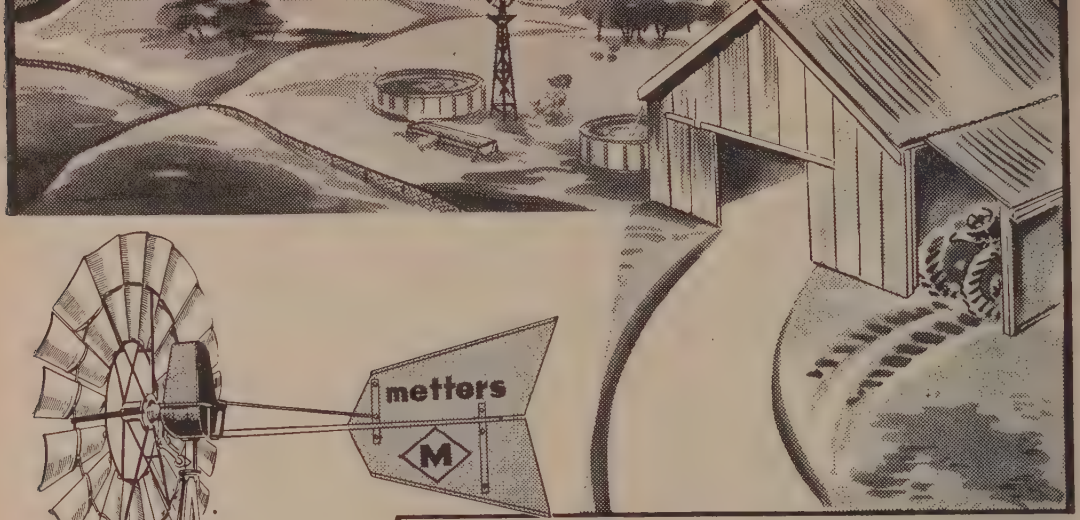
Mr. Baron Hay stated that fleece measurement is a valuable aid to studbreeders in the accurate selection of their sheep.

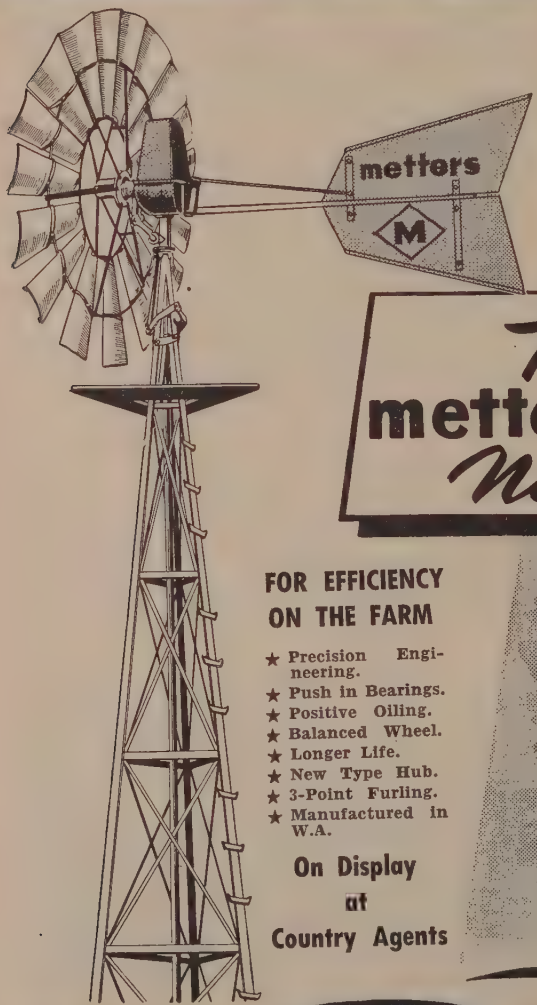
This service is in line with those provided in the Eastern States where a number of major Merino studs, including parent and daughter studs, are participating in similar services.

It is noteworthy that in New South Wales where a service is conducted by the N.S.W. University of Technology, 50 per cent. of the rams now annually sold by parent studs are from studs participating in the flock-testing service in that State.

Laboratory facilities to provide measurements on wool samples forwarded by breeders will be available in Western Australia shortly. These facilities are being established in collaboration with the Technical Education Division, Education Department, who are installing the equipment and hope in future to establish a school of Wool Technology to cover all phases of work in the industry.

Merino studbreeders desiring to participate in this flock-testing service or who require further information are requested to make application in writing to the Officer-in-Charge, Sheep and Wool Section, Department of Agriculture, Perth, or contact their local District Adviser.





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LIST OF PLANT PARASITIC EELWORMS RECORDED IN WESTERN AUSTRALIA

By OLGA M. GOSS, B.Sc. (Hons.), Plant Pathologist

RECENT research work in many parts of the world has indicated that eelworms are responsible for many plant diseases. In Western Australia, apart from the commonly known root-knot eelworms, a number of others have been found associated with disease conditions in orchards, market gardens, etc. The following list shows the eelworm species identified to date as occurring in this State.

The year of first identification is given in brackets following the specific name. All old identifications have been modified or confirmed in recent years.

MELOIDOGYNE spp. (root-knot eelworms)—First recorded as *Heterodera marioni* (1920) but now removed from this genus and subdivided into a number of species.

M. javanica (1955)—Very common on most vegetable crops, ornamentals, grape vines, passion fruit vines and stone fruits, particularly on the coastal sand plain and on bananas at Carnarvon.

M. hapla (1955)
M. arenaria (1955)
M. incognita acrita (1955)
} On grape vines in limited areas in the Swan Valley.

PRATYLENCHUS spp. (root lesion or meadow nematodes).

P. vulnus (1955)—Widespread on apples, pears, grape vines.

P. penetrans—Apples (1955), daffodils (1957).

P. ? brachyurus—ex bananas (Carnarvon).

TYLENCHULUS semi-penetrans (1951)—Citrus nematode very common in all citrus areas.

ANGUINA tritici (1898)—Ear cockle of wheat.

Anguina australis (1958)—Leaf gall of Ehrharta longiflora (first recorded in 1926 but eelworm not identified).

DITYLENCHUS dipsaci (Anguillulina dipsaci) (1947)—Stem and bulb eelworm on daffodil and hippeastrum.

ROTYLENCHUS ? robustus (1956)—Banana roots.

Rotylenchus sp. (1956)—Apple roots.

RADOPHOLUS similis (1958)—Probably the same eelworm as was identified as *Anguillulina similis* or *musicola* (1932)—Banana roots.

PARATYLENCHUS sp. (1955)—Round apple roots and vine roots.

XIPHINEMA sp. (1955)—Round apple roots.

APHELENCHUS avenae (1955)—Round vine roots.

CRICONEMOIDES sp. (1955)—Round vine roots.

HETERODERA schachtii (1932)—Sugar beet eelworm on crucifers and beetroot.

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Fig. 1.—Twin Guernsey—A.I.S. cross heifers at the age of 11 days when they had received whole milk only. Their liveweights were 84 lb. and 90 lb., respectively

THE USE OF DRIED BUTTERMILK TO REAR CALVES

By L. C. SNOOK, D.Sc., Animal Nutrition Officer

ONLY a limited number of calves are reared on dairy farms which sell whole milk. At current prices, it is only a very good calf which is worth more than the milk it would consume, and as a result, the heifer calves from thousands of productive cows are each year slaughtered at birth. In the past the whole milk supplier was able to obtain his herd replacements from farmers in the more distant dairying districts who of necessity sold butterfat and could rear calves on separated milk.

Now, however, these butterfat producers are selling more and more whole milk for processing and they in turn are coming up against the problem of rearing calves on a minimum of milk. Some are already taking the line of least resistance and are rearing few, if any, calves. Obviously, it is a matter of some urgency that dairy farmers should be encouraged to rear the maximum number of heifer calves. The best way to do this is to show that there are cheap and easily used whole milk substitutes.

It is surprising that dried buttermilk has been neglected for so many years as a calf-food. In many ways it is an ideal milk substitute on which to rear calves. It is relatively cheap, it keeps well when stored, and is easily used. Following the successful trials which were carried out at the Animal Health and Nutrition Laboratory and at the Bramley Research Station, a local company is now manufacturing dried buttermilk as a special line for rearing calves. The product is carefully prepared and dried to prevent any undesirable changes taking place during storage. It is sold in cellophane bags which prevent the absorption of moisture. Now that a dependable product is available dried buttermilk can be used with confidence to replace milk in calf rations.

NUTRITIVE VALUE OF DRIED BUTTERMILK

As a calf food, dried buttermilk can be considered to be equivalent to dried whole milk. In actual fact it is dried sour milk in which the lactic acid has been neutralised. Part of the sugar in the fresh milk is changed to acid when the cream goes sour. In turn this acid is neutralised with soda when the dried buttermilk is prepared. It is not possible to extract all the butterfat from buttermilk and the dried product is registered to contain at least 5.7 per cent. fat. The dried buttermilk is rich in the vitamin riboflavin (hence its value as a chicken food) and also contains all the valuable minerals present in fresh milk.

COSTS

Dried buttermilk is a present sold at 87s. 6d. per 100 lb. bag (10½d. per lb.). Whole milk contains about 13 per cent. of solid matter. This means that about one and a quarter pounds of the powder should be mixed with one gallon of water to give the equivalent of milk. This milk substitute can be prepared at a cost of 1s. 1d. per gallon.

METHODS OF FEEDING

In our first trials (Snook, 1953) it was assumed that calves would require whole milk for the first fortnight, after which a gradual change to reconstituted buttermilk would be necessary. This procedure gave excellent results but experience has shown that abrupt changes to dried buttermilk preparations do not cause any upsets. Of more importance is the finding that young calves can be placed on dried buttermilk diets as soon as the colostrum is finished. This means that as soon as the cow's milk is fit for sale the calf can be transferred to the milk substitute. In other words, calves can be reared without any reduction in the volume of milk sold.

The buttermilk solutions are prepared by mixing the dried buttermilk in water at the rate of 1¼ lb. in one gallon. This mixture is fed in the same way as is ordinary milk. In general, the quantity of fluid fed each day should approximate 10 per cent. of the body weight, i.e. a calf weighing 100 lb. should receive a gallon of milk or its equivalent each day.

The dried buttermilk does not dissolve in water; suspended particles quickly settle to the bottom. For this reason it is best to put each calf's ration in a separate bucket and add the water. By doing this one can be certain that each calf gets its quota of solid material. If possible the calves should be fed in bails or separate pens. Small calves cannot thrive if stronger animals can obtain most of the food.

Calf rearing can be made a simple, straightforward job but unfortunately it is all too easy to slip into methods which are careless, haphazard or downright dirty. Good results can be assured but only where strict attention is paid to detail.

Fig. 2.—The same heifers shown in Fig. 1, at the age of 13 weeks after being fed dried buttermilk mixed with bran and pollard and fed as a dry meal. At this age they weighed 182 lb. and 222 lb., respectively

TRANSFER TO DRY FEEDING

Calves should be encouraged to eat dry meals, hay and pasture from the third week onwards. Dry meal can be added in increasing quantities to the bucket after the milk has been consumed. This serves the dual purpose of supplying extra food and discouraging the calves from sucking one another. Buttermilk powder can be used alone or mixed with linseed meal, crushed cereal grain or pollard. Linseed meal gives an excellent "bloom" to calves and a dry meal made up of equal parts of buttermilk powder and linseed meal is recommended. When this is being consumed in sufficient amounts and the animals have learnt to drink water, the liquid ration can be cut out entirely. Many dairymen prefer to continue liquid feeding for some months but calves can be taught to eat an adequate ration of dry food while quite young. So long as care is taken to ensure that all the calves receive their share of a nutritious dry ration, weaning in the sixth week can do no harm.

Clean palatable water is essential in the rearing of healthy calves. Well-cured meadow hay should also be made available. If the calves can be rotated on green pasture so much the better. If good hay or pasture is unavailable cereal grains should be mixed with the dry buttermilk and linseed meal.

COBALT ESSENTIAL

Much of the unthriftiness seen in calves is due to cobalt deficiency. Young animals are particularly susceptible to cobalt deficiency. This explains why unthrifty calves often are seen in areas where the cows appear healthy.

Commercial cobalt chloride or cobalt sulphate is cheap (about 10s. per lb.) and it is folly to risk any deficiency in young stock. If one ounce of the commercial salt is dissolved in one gallon of water, one teaspoonful of the solution will contain enough cobalt for 10 calves each day. It is recommended that a solution of this type should be prepared so that the cobalt supplement can be added to the milk or milk substitute every day.

When the calves are transferred to solid food supplies of cobalt are still essential. Cobalt salt can be mixed with the dry meal (1 oz. per 100 lb.) or Denmark Lick can be used (4 oz. per 100 lb.). Calves do not necessarily eat enough of a salt lick and it is better to place the cobalt in a palatable food mixture. Drinking water can be treated (1 oz. of cobalt sulphate in 5,000 gallons) or the pastures can be treated with a boom spray (4 oz. of cobalt sulphate per acre). (See Leaflet No. 2172.)

Fig. 3.—These twin heifer calves at the Bramley Research Station were fed on reconstituted dried buttermilk

It would save the farmer a lot of bother if cobalt could be added to the liquid buttermilk at the factory before this was dried. The cost would be very small and farmers using dried buttermilk would no longer have any worries concerning cobalt deficiency. After weaning, of course, the calves would still require a cobalt supplement.

POSSIBLE DANGERS

In the initial trials at the Animal Health and Nutrition Laboratory dried buttermilk gave such good results that one wondered why it was not universally used as a calf food. Not only were calves reared successfully from two days of age but calves which had developed scours on whole milk diets were cured when transferred to reconstituted buttermilk (see

illustration). At the Bramley Research Station equally good results were achieved under practical farming conditions.

However, when dairy farmers began to use dried buttermilk, reports were received of excessive scouring and some farmers declared that the product was too dangerous for general use.

These complaints were investigated and it was found that the quality of the buttermilk powder on the market varied considerably. Some samples had not been neutralised properly and contained either excessive acid or excessive alkali. Other samples had not been dried properly and the damp powder had began to decompose. Samples which had been held in store for long periods had absorbed moisture and deteriorated. These stale powders also caused severe scouring.

It follows that dairy farmers must restrict their custom to high quality buttermilk powder. This is now being produced locally and sold in special bags. The dried buttermilk should be of fine texture, free running and of a pale yellow colour. Preferably the bags should have a date ticket so that the use of stale powders can be avoided.

If farmers use a wholesome product there should be no risk of scouring. By the same token, if dried buttermilk is used carelessly, or allowed to become contaminated, it can become as dangerous as rotten meat. Likewise only freshly-prepared solutions should be fed to calves. Fluid which is not quickly consumed must be discarded.

DRIED SKIM MILK

Now that farmers have learnt the value of dried buttermlik, the demand tends to exceed supply. As a result it may be necessary to use dried skim milk powders. This is somewhat more expensive (1s. per lb.), and contains very little butterfat. Dairy farmers, however, have found that the dried skim milk can be used in the same way as the dried buttermilk. The cost can be reduced by mixing in a proportion of linseed meal. Likewise, limited supplies of buttermilk powder can be augmented with linseed meal.

WHEY

The use of dried whey is **NOT** recommended as a calf food. This product contains 70 per cent. milk sugar and can cause serious digestive upsets. Care should be taken to avoid the purchase of dried whey in mistake for dried buttermilk.

SUMMARY

In Western Australia it has become a common practice to rear calves on dried buttermilk.

Fig. 4.—These calves were scouring badly when received at the Animal Health and Nutrition Laboratories. After a few days on reconstituted dried buttermilk, the scouring ceased and the calves began to gain weight

This is reconstituted by mixing the powder with water in the proportion of 1¼ lb. to a gallon.

As soon as colostrum is no longer available, young calves can be transferred directly to the buttermilk solutions.

From the third week onwards increasing amounts of dried buttermilk can be fed as a "meal."

When adequate amounts of dry buttermilk are being consumed, liquid feeding can cease.

Clean water and good hay should be made available from an early age. Green pasture is desirable but not essential.

Scouring and wasting will result if badly-prepared or poorly-preserved buttermilk powder is fed to calves.

Manufacturers now market dried buttermilk which has been processed and packed specifically for use as a calf food.

If dried buttermilk is unavailable dried skim milk can be used.

As the calf develops, increasing quantities of linseed meal can be used to replace dried buttermilk, if this is in short supply.

REFERENCE

Snook, L. C. (1953).—W.A. J. of Agric., 2: 373.

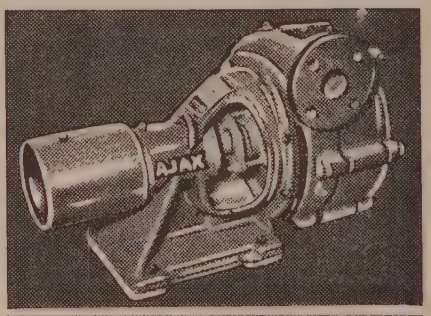
MORE WHEAT RESEARCH

Additional comprehensive investigations of the bread-making qualities of wheats grown in Western Australia were soon to be put into operation, said the Minister for Agriculture recently.

The present cereal research laboratory of the Department of Agriculture was begun in 1937 with the assistance of a generous donation from the W.A. Flour Millers' Association and much good work has been done. Provision in the new laboratories at South Perth would allow for expansion in cereal research commensurate with the importance of cereal growing in Western Australia.

It was generally admitted, said the Minister, that the real test of the quality of wheat is the type of loaf which can be produced from it and for that reason facilities for experimental bread baking will be included in the new laboratory. Other tests used to measure wheat and flour quality will also be conducted as an aid to wheat authorities and flour millers as well as to assist with the experimental programme already planned by the Department of Agriculture.

An officer of the research laboratory had just returned after spending some months working in the cereal laboratories in the Eastern States. He had worked at the Bread Research Institute in Sydney, the Victorian Cereal Laboratory at Melbourne and the Agricultural Research Institute at Wagga, where he had acquired the most up-to-date information on cereal research. At the same time, he had determined the most suitable milling, flour-testing and baking equipment necessary for the expansion of cereal research activities in Western Australia. The research to be undertaken would be closely related to extensive field activities as well as to the department's programme for breeding better varieties of wheat and barley.



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OAT VARIETIES DIFFER IN SUSCEPTIBILITY TO MANGANESE DEFICIENCY

By J. TOMS, B.Sc. (Agric.), Research Officer, Plant Research Division

THE oat variety Avon has been noted to be less susceptible than Dale to manganese deficiency.

Although it is well known that some oat varieties are less affected than others when grown on manganese-deficient land, it has not been considered necessary to carry out experiments on this matter as crops grown on manganese-deficient country should receive additional manganese either by spray or soil application.

However, during the dry 1956 and 1957 seasons when there was a widespread occurrence of manganese deficiency on cereals, two opportunities arose to compare the susceptibility of the two varieties Avon and Dale. The first was at Kendenup in 1956, where the Agricultural Adviser, Mr. Alan Smith of Mt. Barker, noted the much lower incidence of manganese deficiency symptoms in a crop of Avon oats which was sown alongside a crop of Dale in the same paddock.

The second was at Bremer Bay in 1957, where a crop of Dale oats was badly affected by manganese deficiency, but an experiment sown with Avon oats in the middle of this paddock was resistant to such an extent that straw yields were not increased by the addition of manganese sulphate (one of the treatments in the experiment).

Although there is no experimental evidence to back up these observations it would be advisable for farmers to grow Avon oats in any region where manganese deficiency is likely to show up, and where the maturity pattern of Avon is suitable.

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BEEF CARCASS COMPETITION, 1958

THE Beef Carcass Competition which for some years has been conducted by the Royal Agricultural Society on behalf of the Australian Meat Board will again be a feature of the Royal Show this year. Prize money will be maintained at the high level of previous years with £100 and a special ribbon for first prize, £30 for second prize, and £20 for third prize. In addition a special sash will be awarded for the best steer of all entries judged "on the hooks."

Entry forms are obtainable from the offices of the Royal Agricultural Society, the several associated stock agents, the Department of Agriculture and the Australian Meat Board.

In brief, the conditions of entry provide for an even pen of three young steers of any breed or cross, of a quality suitable for export and dressing between 450 lb. and 720 lb. each. The animals must be reared on their own mothers and receive no supplementary feed after June 30. They must be essentially paddock reared; stall-fed animals are ineligible. Two pens are allowed each entrant at a fee of 5s. each pen for members of the Royal Agricultural Society and 7s. 6d. for non-members.

Entries will be exhibited at the Royal Show and then sold on behalf of exhibitors at Midland Junction Saleyards prior to slaughter at the abattoirs.

Judging will be carried out in two sections. The live animals will be first judged as beef types at the show grounds and points allotted "on the hoof." After slaughter at Midland Abattoirs the carcasses will be appraised under the McMeekam System and points awarded "on the hook."

Final points for each entry will be the sum of those allotted under each section.

An important feature of the judging is that for both sections the assessment of points will be based essentially on trade requirements.

By participating in this competition breeders will have an excellent opportunity of gaining knowledge at first-hand of the type of carcass best suited to the markets of today.

Entries close on August 8, at the office of the Royal Agricultural Society, Adelaide Terrace, Perth.

Beef carcasses being appraised at the Midland Junction abattoirs.

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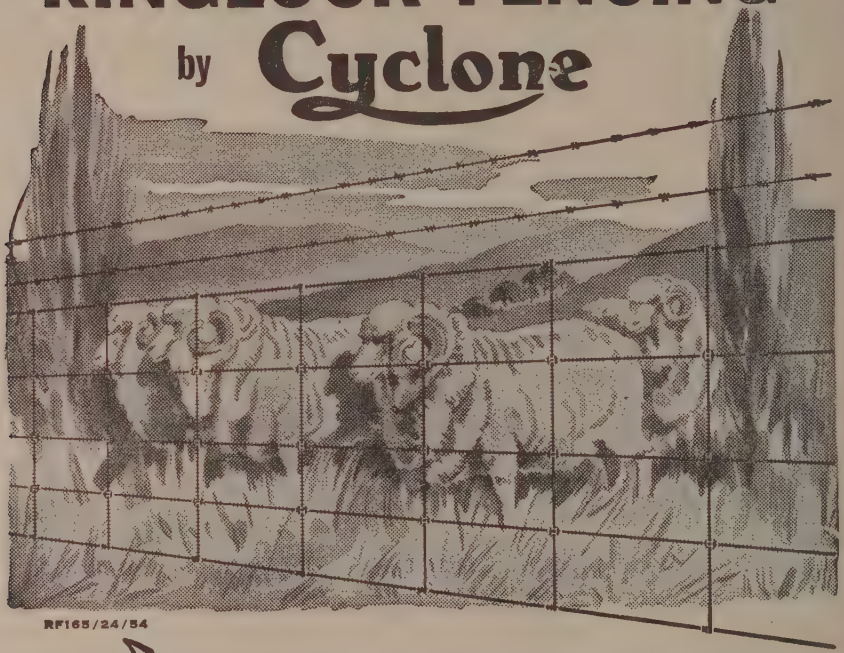

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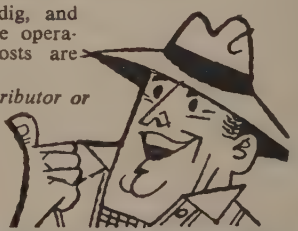

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PLANT DISEASES

PEAR SCAB

Results of Recent Spray Trials

By R. F. DOEPEL, B.Sc. (Agric.), Plant Pathologist

SCAB or black spot is the most important disease of pears in Western Australia where for many years it has seriously affected both yield and quality of fruit. In seasons favourable to its development, the disease has proved difficult to control with the older copper and sulphur fungicides. Excellent control has been obtained in recent spray experiments with the newer organic fungicides captan and the phenyl mercury compounds. Eradication of the disease in isolated orchards has been achieved by the use of phenyl mercury sprays in the autumn before leaf-fall.

The varieties of pears grown in Western Australia vary somewhat in their susceptibility to attack by the scab disease. Bartlett, Josephine and Packham's Triumph are very susceptible while Kieffer is more resistant.

SYMPTOMS

Leaves. — Symptoms become obvious within two or three weeks after infection as small, slightly sunken, dark spots occurring mainly on the undersurface of leaves. On closer examination corresponding swellings can be seen on the upper leaf surface. These spots enlarge rapidly and numerous conidia or "summer spores" are produced on them, colouring affected areas a dull olive-green or black (Fig. 1). Large spots cause curling and malformation of the leaves and give the surface a blistered appearance.

Fruit.—Infection may occur on flower stalks or developing fruits during the blossoming period. Small black spots are commonly found just below the calyx and are covered with masses of conidia. Infected blossoms often drop and so may cause a considerable reduction in fruit set.

Spots on the fruit are similar, in the early stages, to those found on the leaves. At first they are slightly sunken but, as the fruit develops, the spots enlarge and may cover a considerable area of the skin (Fig. 2). Conidia are produced in large numbers on the lesions which then become the same dull olive-green or black colour as that of the leaf spots. Older lesions develop a dry scabby texture and cause malformation of the fruit rendering them either unmarketable or else of an inferior grade.

LIFE CYCLE OF THE SCAB FUNGUS

The pear scab fungus, *Venturia pirina*, Aderh., overwinters from one season to the next in infected leaves which fall to the orchard floor. During winter the fungus continues to grow in the dead leaf

Fig. 1.—Pear leaves showing black spots typical of the disease

tissues and produces numerous flask-like fruiting bodies known as perithecia. Two-celled ascospores or "winter spores" develop in these perithecia and when mature are forcibly discharged into the air in the spring. Moisture, in the form of rain or possibly heavy dew, is necessary to bring about the discharge of mature ascospores. Depending on weather conditions the spores are ejected from the perithecia at intervals, commencing before bud burst in September and continuing for about three months. They can be blown considerable distances by wind and so are able to infect other orchards in the district.

Moisture must also be present on the leaves and fruit before the ascospores which land on them can germinate and infect the tissues. Showers of rain, therefore, serve a dual purpose in releasing ascospores from the perithecia and also enabling them to infect the trees in the orchard.

Germinating ascospores send out fungal threads into the leaf and fruit tissues and the black spot infections become obvious after an interval of two or three weeks. In general cool wet weather favours infection while dry warm conditions check development of the fungus.

A different type of spore, the one-celled conidium or "summer spore," develops in large numbers in the leaf and fruit spots giving them the dull appearance referred to earlier. These spores are spread by wind and rain causing further infections in addition to those initially caused by ascospores.

If temperatures are favourable, succeeding outbreaks of scab in the orchard can be traced to rain periods which occurred a few weeks previously.

Diseased leaves fall to the ground in the autumn and so enable the fungus to complete its life cycle.

CONTROL ASPECTS IN RELATION TO LIFE CYCLE

From a study of the life cycle it is apparent that control of the scab disease can be attempted in two ways—(1) by preventing carry-over of the fungus in fallen leaves and so stopping ascospore production; (2) by applying fungicidal sprays to prevent spring infection from ascospores and subsequently from conidia.

(1) In past years a measure of scab control was obtained by ploughing under the overwintering leaves in early September before bud-burst. Subsequent cross-cultivation was delayed as long as possible to prevent the buried leaves from being brought to the surface. In this way many of the ascospores were discharged harmlessly into the soil and as a result primary spring infection was reduced.

An alternative method of stopping the spore discharge has now been tested and consists of spraying the trees in the autumn after harvest but before leaf-fall, with phenyl mercury chloride (PMC). This method was first developed by the New South Wales Department of Agriculture for use against the closely-related apple scab disease. Hutton (1957) found that scabbed apple leaves sprayed with 0.1 per cent. PMC failed to develop ascospores in the spring. As these spores can be carried several miles by wind to neighbouring orchards, this method would be of value mainly for an isolated orchard or group of orchards in an isolated district. Investigations on the use of autumn PMC sprays against pear scab have been carried out in this State during the past three years.

(2) In most seasons, a reasonably clean crop can be assured only by adopting a regular fungicidal spray programme in spring and early summer. For many years spraying with Bordeaux mixture or lime sulphur has been the standard treatment for the control of scab. However, these fungicides cannot be safely used on certain varieties after the white bud stage because of russet damage to the fruit. In recent experiments several of the newer organic fungicides have proved more effective and safer to use than Bordeaux mixture.

These fungicides can be grouped into two types according to their mode of action:—

Protectants—such as captan, ziram and thiram, which are applied to protect healthy fruit and leaves from infection by the ascospores or conidia. They give best results when applied before a rainy period, i.e., before infection can occur. Hence these sprays should be applied in the spring and early summer at regular intervals not exceeding 14 days, to maintain a protective cover of fungicide on the new growth (Hey, 1956).

Eradicants—such as the phenyl mercury chloride or nitrate compounds, which can kill out or eradicate recent infections following on rainy periods. These materials, however, have little value as protectants for their action in this regard does not persist for more than a few days (Hey, 1956). Sprays containing phenyl mercury compounds are best applied immediately after rain and are useful where the normal protectant spray programme breaks down because of adverse weather conditions.

FUNGICIDAL SPRAY EXPERIMENTS

Results of Spray Trials.

(a) *Spring.*—The performance of a number of the newer organic fungicides

Fig. 2.—Bartlett fruits severely affected with scab. Both young and old lesions are present on the skin

Fig. 3.—Josephine fruits damaged by phenyl mercury chloride spray applied at petal fall. Note cracking and russeting of the skin. Unsprayed fruit at right

has been tested for pear scab control over the past four years.

At Parkerville in the 1953-54 season, captan and phenyl mercury fixtan (PMF) proved superior to ziram and thiram on Packham pears. The best control was obtained with a five-spray schedule—at spur-burst, white-bud, petal-fall, and two subsequent cover sprays at 14 and 20 day intervals respectively.

In the 1956-57 season three spray schedules—captan, phenyl mercury nitrate (PMN) and captan plus PMN, were tried on Bartlett pears at Karragullen. Best results were obtained with the mixture of captan plus PMN which combined both protectant and eradicant action.

Additional information obtained from experiments can be summarised as follows:—

1. Captan may be safely applied during bloom to give additional protection against scab infection.

2. The phenyl mercury chloride sprays (containing 0.002 per cent. mercury) caused severe russeting and dwarfing of fruits of the Josephine variety when applied at petal-fall (Fig. 3). Slight russeting also occurred with this spray on fruits of the Bartlett, Packham, Comice and Kieffer varieties when applied a fortnight after petal-fall (Fig. 4).

3. Leaf-mottle developed on all varieties sprayed with phenyl mercury chloride at the above strength but apparently had no adverse effect on tree vigour or yield.

(b) *Autumn.*—In the autumn of 1956 a phenyl mercury chloride spray at 0.1 per cent. strength (containing 0.067 per cent. mercury) was applied to 12 pear trees affected with scab in an isolated orchard at Dwellingup. This orchard was located in a heavily-timbered area about three miles from the nearest neighbouring pear orchard. Considerable leaf-fall had occurred at the time of spraying, on April 24, and it was not possible to contact all fallen leaves with the spray. However, most of these leaves were raked together and burnt. Sprayed leaves collected from the trees and overwintered at Perth produced few perithecia and no ascospores were detected.

The following spring there was no evidence of the disease in the orchard until after petal-fall, when scab was detected on a very few leaves and fruit. Captan at 2 lb. in 100 gallons was then applied twice to check the disease.

The autumn experiment was repeated in the 1956-57 season at Dwellingup and in addition, the PMC spray was applied to three severely scabbed trees in another

isolated orchard at Bedfordale. Both properties were sprayed at the end of March and complete defoliation occurred within a few days of spraying. This sudden defoliation was probably aggravated by hot weather conditions which followed the spray applications.

The trees at Dwellingup have remained free of scab this season and at Bedfordale scab lesions were found on four leaves only. No spring sprays were applied at either property.

CONTROL MEASURES

Based on the results of recent spray trials the following schedule is recommended for pear scab control:—

A.—SPRING AND EARLY SUMMER.

Time of Application	Material	Strength
Spur-burst .... and White-bud	1. Captan *or* .... 2. Captan plus .... Phenyl mercury compound. (Do not use on Josephine variety.)*	1½–2 lb. in 100 gals. 1½ lb. in 100 gals. ¾ normal strength. †
Bloom‡	Captan	1½–2 lb. in 100 gals.
Petal-fall	1. Captan *or* .... 2. Captan plus .... Phenyl mercury compound	1½–2 lb. in 100 gals. 1½ lb. in 100 gals. ¾ normal strength.
After Petal-fall at 12–14 day intervals depending on weather conditions	Captan	1½–2 lb. in 100 gals.

NOTE.—*1. Because of risk of spray injury the phenyl mercury compounds should **not** be used on the Josephine variety and no later than petal-fall on all other varieties.

†2. The amount of phenyl mercury compound (chloride or nitrate) to be used in the spray mixture containing captan will depend on the brand used, but is approximately three-quarters the normal concentration.

‡3. Captan can be safely applied during the blossoming period to prevent infection occurring at that time. This spray would be of value for varieties in which the interval between the white-bud and petal-fall stages exceeds 14 days.

B.—AUTUMN.

Time of Application	Material	Strength
After harvest but before leaf-fall. Avoid spraying during high temperature periods	Phenyl mercury chloride	0·1% active ingredient.

NOTE.—At present this autumn spray is considered only as a supplement to the normal spring spray programme. Complete eradication of pear scab can only be expected if the orchard is well isolated from neighbouring orchards or if all orchards in an isolated district are treated. It is important to spray

Fig. 4.—Packham fruits showing skin russeting resulting from phenyl mercury chloride spray applied a fortnight after petal fall. Unsprayed fruit on left

thoroughly all leaves on the trees and also any leaves which have fallen to the ground.

At current prices 100 gallons of 0.1 per cent, phenyl mercury chloride spray would cost £9 10s. However tests are proceeding with weaker strength PMC sprays to ascertain if costs can be reduced.

ACKNOWLEDGMENTS

Appreciation is expressed for the assistance given by Messrs, Mayor and Brindle, Parkerville, L. W. Wheatley, Bridgetown, T. W. Stewart, Dwellingup and G. Casotti, Karragullen, in making their orchards available for the spray trials. The help of Horticultural Field Instructors in conducting the experiments is also acknowledged.

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MURESK AGRICULTURAL COLLEGE

(Department of Agriculture)

Parents are reminded that applications for 1960 admission to Muresk Agricultural College close on 31st December of this year. A preliminary selection of 1960 entrants is made after the Junior results are available early in 1959.

The successful applicants then continue with Sub-Leaving, or higher studies, in 1959.

Before the course can be commenced students must have attained:—

(a) Sub-Leaving Standard in English, Maths. A, Chemistry and Physics (including Magnetism and Electricity).

(b) Junior standard Bookkeeping.

Should places still exist for 1960 commencement after the preliminary selection early in 1959, they are filled in order of application during 1959, by qualified applicants.

Some places still exist for 1959 commencement and are now being filled by qualified applicants, i.e., those who have or are now taking the correct course at Sub-Leaving or higher standard.

Duration of Course.—Two years.

Fees.—Approximately £130 per annum covering full residential charges.

Scholarships.—Department of Agriculture (3), the "Countryman," and J. J. Poynton Memorial (2).

Boarding Allowance.—Most Muresk students are eligible for the Education Department Boarding Allowance (£50 per annum).

Full details of the College are obtainable from the Principal, Muresk Agricultural College, Muresk, W.A., or the Department of Agriculture, Perth.

TOMATO FRUIT QUALITY

The Effect of Mechanical Injury

(The second article of a series dealing with the problems of the Geraldton Industry in relation to fruit quality.)

By D. A. JOHNSTON, B.Sc. (Agric.), Agricultural Adviser

ONE of the major causes of fruit loss, and reduced quality with Geraldton tomatoes, is due to injuries suffered during handling. It is considered that the greatest immediate improvement in tomato quality, may be obtained by exercising greater care during the harvesting, grading and packing of the fruit.

Investigations carried out at Geraldton during the 1957 season, highlighted the role of mechanical injury in relation to quality. Tomato fruit samples were collected from several properties. The samples were not too large and hence could be readily examined and checked. In addition, growers were asked to supply fruit which was representative of the type of fruit being consigned to Melbourne. In this way, quality could be said to approximate as closely as possible, the quality of fruit consigned to export markets.

Upon receival, the fruits were placed in an unheated room and stored for a period of one week. This approximates the time taken in transit to Melbourne. After examination, they were then placed in a ripening room with a temperature of 65° F. They were examined at weekly intervals, and were retained until they were either full ripe or were beginning to break down. Fruit samples were divided into two in some cases, one lot being stored on open shelves, the second lot being stored in polythene bags. All other fruit samples were stored on open shelves with free air circulation.

OBSERVATIONS

The majority of breakdowns as recorded in the ripening room was due initially to mechanical injury. It is doubtful if any fruit sample received was devoid of some form of such damage. Again, it must be remembered that the fruit samples studied, were not packed in cases, and were not jolted or roughly handled after receival.

The types of damage evident on the fruit samples were:—

(1) Bruising—mainly on shoulders.
(2) Skin scratching.
(3) Skin lesions—small cracking.
(4) Pitting—may be due to sand blast or sand in containers.

Damage to tomatoes by mechanical means, does not only show itself in direct injury to the fruit. Once the tomatoes are bruised, scratched or cut in any way, the damaged areas generally break down, and become more open to the attacks of fungi and perhaps insects. The initial amount of mechanical damage may have been slight, but once the injured fruit is attacked by parasites, substantial losses can be expected.

SECONDARY INFECTION

The main disease attacking damaged tomato fruit was the Early Blight fungus (*Alternaria* sp.). Other storage rot fungi were also noted on fruit stored in polythene. This type of secondary damage generally fails to develop until some time after the initial mechanical injury occurred. With tomatoes exported in a mature green condition, fungi may not develop until the fruit are placed in the ripening room, and may not appear until some two weeks after the fruits have been consigned to their destination.

The quality of fruit attacked by Early Blight deteriorates rapidly, and such fruit quickly become unsaleable. In a tightly-packed case, one infected tomato can easily spread the disease to adjacent fruit and in this way wastage becomes severe. To control the destructive effects of secondary infection, it becomes clear that an effort must be made to limit the initial cause of such infection. That is, reduce mechanical injury and use fungicides to control the disease.

Good control of Early Blight may be obtained by the regular use of Zineb sprays. During wet weather more frequent sprayings are required. Fresh spray residue on the tomato fruit, reduces the fungi spore load on the fruit and limits infection.

HOW DAMAGE OCCURS

Damage to fruit may occur in several ways of which the following appear the most important.

1. During picking and tipping into field boxes. The fruit are often dropped vigorously into tins or buckets. Padding on the edges and on the bottom should reduce this bruising. The edges of field boxes were frequently observed to leave quite large depressions in the fruit walls, which ultimately develop as bruises which break down. Several growers have noticed this and see to it that their tomatoes are gently emptied into boxes which are padded with bags or other material. This practice has been found to pay dividends and is recommended to limit this type of damage.

2. During tipping on the grader bins or shelves. Many bins on mechanical graders are too high. Admittedly the bins are often high to facilitate the flow of tomatoes along the grader, but this also means that the fruits are tipped too vigorously into the hoppers.

3. The speed of fruit along rollers. Fruits were seen to strike the edges of the rollers with considerable force. Padding of all edges with soft sponge rubber is advised. The roller speeds are often too great, and the fruits are bumped and scratched in the process. Much of the shoulder bruising seems to occur during the grading operations.

4. During packing. Under the present system the tomatoes have to be tightly wedged into the case. Pressure must be exerted to hold down the lid for nailing. The thin paper lining does not afford protection, and many fruits are bruised, squashed and even split during this operation. Perhaps the other types of packs, such as a scrambled pack, packing in cardboard cartons which are not completely rigid, or wrapping of fruit, could reduce the incidence of bruising.

5. During transit. Considerable bruising must occur during transport, but this type of injury cannot be controlled by the grower. A case of tomatoes returned to Geraldton by air from Melbourne, showed that severe bruising and crushing were the reasons for an almost 100 per cent. wastage. Early Blight was the only fungus noticed attacking the fruit. The loading and unloading which is carried out at least three times by indifferent handlers, does not make for a good quality sample reaching the ripening rooms.

There are several other minor factors causing injury to fruit, which deserve some mention. Pulling the fruit from the plant may cause the lifting of small sections of skin at the junction of the fruit stalk and the tomato. Sand in containers and on grading shelves was seen to leave small pits in the skin of the fruit. Studies on the fruit samples in the ripening room, showed that even such small amounts of skin damage as these, can readily become infected with the Black Spot and so reduce fruit quality.

It will be seen that some form of mechanical injury is initially responsible for the damaging secondary infections common with export fruit. To retain the quality of the tomatoes, it becomes apparent that every effort must be made to reduce the amount of mechanical damage on the farm. Any steps taken by growers, handlers and agents to reduce such damage will be repaid in better quality fruit, higher prices and greater satisfaction to all concerned.

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Summer Feeding of Oat Grain to Weaner Beef Steers

By N. DAVENPORT, B.Sc. (Agric.), Senior Adviser, Meat Production

BEEF breeders commonly market their cattle as weaners and up to a year old between November and February and thus avoid carrying them over the late summer and autumn period when weight losses usually occur on normal paddock grazing. The effect of this concerted selling is a pronounced downward trend in price levels which are not normally regained until the following May-June period, by which time the pressure of supply has eased considerably.

The pattern of market price levels and trends and typical of the last few years, is shown in graph form.

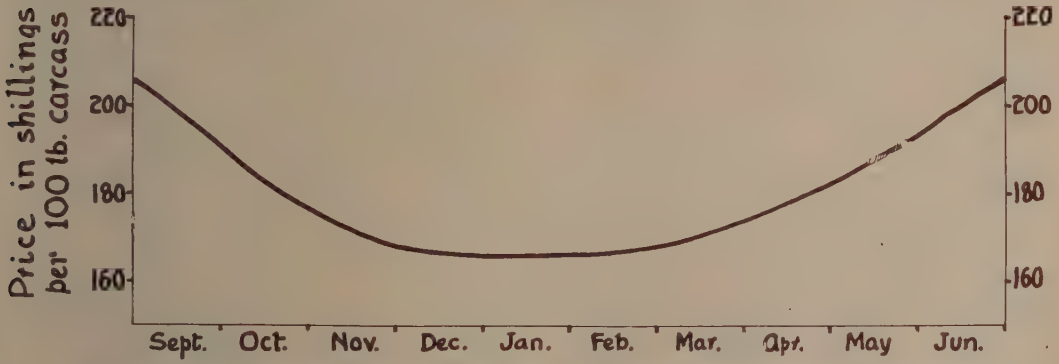

Fig. 1.—Graph showing price trends of "baby beef" at the Midland Junction livestock markets.

In order to avoid these lower prices the breeder may decide to hold the weaners over the summer for marketing later. In such cases he has to decide whether he should supplement the grazing to ensure that the animals continue to gain in weight even if at only a comparatively low rate, or allow them to lose weight in the normal sequence and depend on the new season's pasture to bring them to marketable condition in time to sell at more favourable values.

A fact-finding trial designed to provide information on this matter was carried out during the summer of 1955-56* at "Cranmore Park," and repeated the following summer, 1956-57. This property is one of the three centres at which the Department of Agriculture is carrying out investigations dealing with the production and management of beef cattle in the agricultural areas. At each centre weighing facilities have been provided by the Australian Meat Board.

DESCRIPTION OF PROPERTY

"Cranmore Park" is the well-developed stud sheep property of the Boolardy Pastoral Company on which a commercial herd of beef cattle is carried in association with the sheep, primarily in order to improve pasture management and utilisation. It is situated about nine miles north-east of Walebing in the Moora district and has an average annual rainfall of 17

* See W.A. Journal of Agriculture, 1957, Jan.-Feb., p. 99—interim report.

inches. The growing season extends from May to October when 14 inches of this total is recorded. The remaining summer period of six months constitutes the recognised "annual summer drought."

The country is undulating with ample tree shelter for stock. The natural tree cover is principally Salmon Gum (*Eucalyptus salmonophloia*), Gimlet (*Eucalyptus salubris*), and York Gum (*Eucalyptus loxophleba*), and is in association with grey and red-brown clay loams and loams. Jam (*Acacia acuminata*) and scrub species were carried on the lighter sandy loam soil types.

Subterranean clover (Dwalganup) has been well established on the medium and lighter country and is in association with the common annual volunteer species (principally barley grass, brome grasses, erodium, capeweed, and the so-called native clovers). Pastures on the heavier soils consist of Wimmera ryegrass and the above volunteer annual species, together with burr trefoil (*Medicago denticulata*) and some subterranean clover.

PARTICULARS OF EXPERIMENTS

For the purpose of the experiment 30 crossbred weaner beef steers were used on both occasions. They were of March-April drop, sired by Shorthorn, Hereford and Aberdeen-Angus bulls. Most of them were out of grade Aberdeen-Angus cows and the remainder had first cross A.A. Shorthorn mothers. The steers were weaned in December of each year and the supplementary feeding was commenced early in January on both occasions. For this purpose they were divided into two groups of 15 each with equal numbers of the same breeding in each. Identification was by numbered fire-brands. The steers were weighed regularly at four-weekly intervals throughout both experiments.

The three common cereal grains, oats, wheat and barley are all used to supplement paddock grazing during the dry period. As the number of animals and the amount of practical detail involved in the investigation precluded more than one fodder being tested, oat grain was selected as it is probably the most commonly-used over the major part of the beef producing areas. It was fed whole.

1956 EXPERIMENT

Summer Feeding Period.

From January 3 to May 8, the fed group received 5 lb. oaten grain per day except that 2½ lb. was fed per day for the first fortnight. It was put out daily in feeders with ample room for all steers to feed at the one time. The control group had paddock grazing only. The groups were rotated between paddocks to ensure similar grazing conditions for both throughout the experimental feeding period.

Grain feeding was terminated at the commencement of the winter rains.

The previous growing season (1955) had been above average and therefore summer paddock grazing was ample and of good quality. Sheep were grazed with the control cattle but not with the fed group.

The experimental areas were mainly topdressed pasture consisting of subterranean clover, burr trefoil and the usual volunteer species. Also included was an oat crop which had been mown at the very early flowering stage and left as cut. Some 30 acres of the pasture area had been mown at the hay stage and left for grazing.

Temperatures were generally slightly above normal until mid-April, and January was very hot. The rainfall was below average. During the feeding period rain fell on one day only (50 points on March 4) until April 11. Two inches were recorded during the next four weeks (139 points on May 6 and 7.)

Winter Period.

At the end of the oat-feeding period both groups were joined as one herd and had normal paddock grazing until sold towards the end of September, 1956.

They were held after the expiration of the feeding period in May, as it was decided to determine whether the group which received the grain supplement would continue to do better than the "grazing only" group under normal winter grazing conditions.

Average weights of the two groups at the beginning and end of the feeding period and at slaughter are shown later.

1957 EXPERIMENT

Summer Feeding Period.

This year the feeding of the oat ration was commenced on January 3 at 2½ lb. per day for the first four weeks and then raised to 5 lb. for the remainder of the period. Because of the late opening of the winter season, feeding was continued until June 7.

With the exception of 40 wethers with the fed group for the last fortnight of April, each group grazed alone until the last five weeks of the feeding period when 60 ewes and lambs were run with both herds. The sheep feeders did not permit access by the cattle of the control group and the converse was true for the fed group.

Following upon an adverse growing season, paddock grazing was noticeably inferior to that of the previous summer. The groups were alternated each fortnight between two areas. One consisted of 60 acres of a light oat crop which had been mown at early flowering and left together with 90 acres of a predominantly brome grass—barley grass pasture with a slight admixture of burr trefoil. The other area of 80 acres was a similar predominantly grass type pasture with a small proportion of subterranean clover. Since drying off, these areas had been grazed appreciably prior to the introduction of the cattle.

During the experimental feeding period, temperatures were normal except that most of January was above average. Again there was very little rain. Only one inch (on 6 days) fell before May during which month 141 points were recorded.

Winter Period.

The cattle were again held over the winter months to compare liveweight trends of both treatments subsequent to the experimental feeding period. They were slaughtered in mid-September.

RESULTS

Liveweight trends and other pertinent data are shown in the following table:—

Beef Cattle Investigations—Cranmore Park

Liveweight trends of groups of fed and unfed weaner beef steers during and subsequent to a summer experimental feeding period together with slaughter data.

1956 EXPERIMENT

Group	No. of Animals	Summer Feeding Period				Average Weight at Slaughter	Gain after Feeding Period	Average Carcase Weight	Average Dressing
		Average Weight at Commencement	Average Weight at End	Liveweight Gain	Gain due to Feeding Grain				
		lb.	lb.	lb.	lb.	lb.	lb.	lb.	%
Fed, Jan. 3 to May 8	15	591	699	108 (0·86)	40 (0·32)	920*	221 (1·59)	489	53·2
Control grazing only	15	576	644	68 (0·54)	....	849	205 (1·47)	442	52·1

* Slaughtered on September 24.

1957 EXPERIMENT

Fed, Jan. 8 to June 7	15	610	697	87 (0·58)	105 (0·70)	907†	210 (2·06)	501	55·2
Control grazing only	15	610	592	18‡ (0·12)‡	....	818	226 (2·22)	434	53·1

† Slaughtered on September 17. ‡ Denotes loss. Figures in brackets denote daily weight gains.

Fig. 2.—Fed group in scale enclosure — Cranmore Park, March 5, 1957. Average weight 649 lb.

During the first summer the control group continued to make gains throughout the period at the average rate of ½ lb. per day for each animal.

The additional oat grain ration which amounted to a total of 15 bushels per beast resulted in a further gain of 40 lb. over the 18-week period which is equal to ⅓ lb. per day. The current value of feed oats at harvest time of both years was in the vicinity of 7s. per bushel. Young beef about May and June brought approximately 200s. per 100 lb. of carcase. At these levels the oats fed cost 105s. and the extra carcase return was valued at 45s. The feeding did not pay for the increased weight.

When the experiment was repeated the next summer (1957) the liveweight changes of the control group reflected the lower value of the grazing. Instead of gaining as in the previous year, this group lost weight, but only to the extent of an average of 18 lb. per beast over the 21-week period and equal to 0.12 lb. per day. The fed group showed a response much greater than for the previous year to the grain feeding and gained 87 lb. over the period which with the 18 lb. loss of the controls made a total effective difference of 105 lb. In this case the value of the oats fed (17 bushels per beast) was 119s. and that of the extra carcase produced was 106s.

As the cattle were not slaughtered immediately after each of the experimental feeding periods it was not possible to compare the quality of the carcasses of each group at those times. However, field observations were that for the first year there was only slight difference between the groups in favour of the fed animals and both looked well. For the second year there was a marked difference. The fed group was attractive with a number in good marketable condition while the majority of the controls were in fair condition only.

Liveweight increases during the winter following the experimental feeding periods until slaughter, were similar for both groups. Taking the two years results into account, the fed group had obviously no advantage over the unfed groups during this time. The early gain (20 lb.) of the fed group for the first two months in the first year was not repeated the following winter and in fact the converse was true, the control gained 13 lb. more than the fed group for the same two-monthly period.

At slaughter, during the latter half of September each year, the fed group dressed out at a higher figure than the controls in each case. The difference was more marked in the second year.

In appearance, prior to slaughter, there was little to choose between the groups of the first trial but the difference was more noticeable in the second year when the control cattle required more time to gain prime marketable condition.

DISCUSSION

It is interesting to note that during the first summer the quality of the grazing was such that the control group continued to make gains throughout this period at the average rate of ½ lb. per day for each animal. This result was due partly to the

Fig. 3.—Fed group feeding from pressed metal feeders—Cranmore Park, April 10, 1956. Average weight 681 lb.

ample paddock feed of good quality resulting from the excellent season of 1955 and partly also to good pasture management in that some of the pasture and also an oat crop in the very early flowering stage, were mown and left lying in the paddocks.

At several of our research stations it has been clearly shown that this mowing treatment prevents much of the loss in food value of the grazing which occurs when the pasture matures beyond the hay stage. This mown material has a higher carrying capacity and also is more suited to the development of growing animals because of its higher protein content than that of normally matured pasture.

During the second summer the animals did better than was expected with the grazing available. The explanation probably lies in the fact that the season finished sharply and prematurely resulted in the herbage "haying off" and so retaining more of its feeding value.

In both years the control animals were quite healthy. The results show that at these two fairly divergent levels of summer paddock grazing it did not pay to feed oat grain at the rate used in order to produce extra beef from healthy weaners. At current prices the same result would apply to wheat and barley.

However, it is obvious that where the summer grazing is inadequate for keeping the stock healthy and in reasonable condition, some form of supplementary feeding is essential. Good quality meadow hay and silage are well suited for this purpose and self-feeding from supplies conserved where the material is cut is both effective and cheap.

It was decided to feed the oats whole. Undigested grain showed in the droppings but to a minor extent and it appeared doubtful if it would have paid to crush. However, oats should be cracked or lightly crushed for cattle from about a year old.

SUMMARY

Weaner beef steers were fed a daily ration of 5 lb. of oats for four to five months during the summer in addition to paddock grazing *ad lib.*

The experiment was repeated the following summer and for both periods the liveweight increase due to the oats did not pay for the cost of the grain.

When grazed on good quality improved pasture, the unfed steers made an average live weight increase of ½ lb. per day throughout the experimental feeding period and were in good condition at the commencement of winter. On fair grazing only, similar steers the next year lost weight (18 lb.) over the experimental period and were in only fair condition at the end of the period.

From the end of the experimental feeding period until slaughter, when both groups were run together, there was no difference in liveweight increase between them.

At slaughter, the fed animals dressed out at a somewhat higher percentage than the control.

Mowing surplus pasture at the hay stage is a sound practice for providing good quality paddock grazing for the summer and autumn at small cost.

ACKNOWLEDGMENTS

The excellent co-operation and helpful advice of Mr. P. Lefroy throughout the experiment is gratefully acknowledged.

The assistance rendered by Messrs. G. H. Neil and B. Carlin of the Moora Office of this Department is appreciated.

The management and staff of the Midland Abattoirs provided the facilities for inspection and appraisal of the carcasses and their assistance so freely given is also much appreciated.

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Pour the ARZEEN mixture—about 1 quart of solution per tree of 12 in. diameter is sufficient—into the frill, right around the tree.

IMPORTANT

1. Ensure the frill is level and as near to the ground as possible.
2. Apply the mixture with a utensil having a spout—i.e., an unwanted teapot.
3. The frill must run completely round the tree, with each cut overlapping.
4. Treated trees can be easily recognised if a little whiting is mixed with the solution before application.

ARZEEN LIQUID WEEDKILLER—Use 1 in 19 solution. The strongest arsenical liquid on the market—costs less than 3d. per tree.

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Book Review

HOW TO KNOW WESTERN AUSTRALIAN WILDFLOWERS—Part 2

By W. E. BLACKALL and B. J. GRIEVE

Following the publication of Part I of "How to know Western Australian Wildflowers," by W. E. Blackall, we have now received a copy of Part II by W. E. Blackall and B. J. Grieve.

This volume, smaller than Part I, contains keys and diagrams of the plants found in South-Western Australia belonging to the following families: *Dilleniaceae, Elatinaceae, Frankeniaceae, Goodeniaceae, Guttiferae, Malvaceae, Lythraceae, Rhamnaceae, Sapindaceae, Sterculiaceae, Thymelaeaceae, Tiliaceae and Violaceae.*

There are a number of good coloured plates of some of the more attractive plants, and a key to the families which has been modified from that which appeared in Part I.

We welcome this little book which will do much towards creating an interest in the flora for the man in the street who wishes to discover the identity of the plants in which he is interested. An improvement on Part I is the employment of much better diagrams and sketches for which we are indebted to Miss J. Rayner, who faithfully depicts the characters required for the easy recognition of the plants concerned. These diagrams are simple, clear, and of faithful delineation, and supply the deficiencies of the text.

In compiling the work the authors have leaned heavily on the previously published work of Bentham in the "Flora Australiensis," and more particularly on the monographs of Krause (*Goodeniaceae*) and Summerhayes (*Frankeniaceae*), and we would like to have seen a treatment based on original observations which would not only have corrected certain mistakes, but perhaps resulted in more easily-recognised characters on which to work. The distribution of the species is not well handled; here and there we find species from regions farther north than the area covered by the map which indicates the geographical scope of the book, and this must lead to some confusion if not to errors in determining the plants. Another unfortunate error is that although the family *Vitaceae* is included, the curious statement that "no species are normally present in the temperate regions of Western Australia" despite the fact that the native grape is a fairly common plant between Shark Bay and the Hill River.

The book does not claim to be a Flora, but the authors have seen fit to make certain nomenclatural changes, and in instances have substituted synonyms for the better known and valid specific names of common species. A number of unpublished names appear in Part I, taken from specimens in the State Herbarium, which are *nomina nuda* and as such have no official standing. Fortunately only one or two of these have been seen in Part II, but it would have been desirable to have acknowledged these rather than included authors' names which are quite unintelligible, such as *Plagianthus Gardneri* Gardn. MS. No plant of course could have been so named.

Apart from these criticisms the book has a definite value for students who are interested in the plants of Western Australia, and for whom there is as yet no official Flora. The inclusion in the index of general notes on distribution, considerably facilitates the task of identification, and its omission from Part I is unfortunate.

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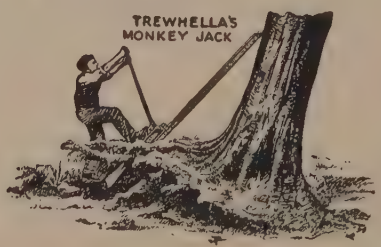
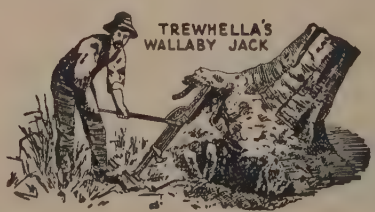




LIGHT LAND DEVELOPMENT IN THE SOUTH

By A. S. WILD, Assistant Superintendent of Wheat Farming,
Department of Agriculture

IT is only since World War II ended that successful large scale development of light land near the south coast of this State has been undertaken, although the many millions of acres of treeless plain country throughout the agricultural areas have, for many years, presented a challenge to the pioneering ability of Western Australians.

Since the establishment of the Wongan Hills Research Station over 30 years ago, we have gathered a fund of information and experience in this type of country and, with our increased knowledge of these light soil types, we are better equipped to undertake their large-scale development.

Although most of our light land is inherently low in phosphate, nitrogen and certain trace elements and the physical condition of the soil presents certain problems, we are fortunate in being able to overcome many of these disabilities. Both phosphate and trace elements are comparatively easy to apply and with suitable leguminous pastures, it is possible and practicable to build up the nitrogen content and improve the physical condition of the soils whilst at the same time we can expect returns of produce sufficient to make their development an economic proposition.

The southern light land, especially that within about 30 miles of the south coast area, is favoured by a sure and adequate rainfall and a growing period which ensures ample scope for profitable development in a reasonably short time. Much of this country, although sandy on the surface, has a clay sub-soil within a reasonable depth which assists in the retention of moisture and plant nutrients as they are accumulated in the soil.

The large tracts of light land, extending from Albany to beyond Esperance, were included in those under consideration for settlement of ex-servicemen, and much of this has been, or is being, utilised for this purpose. The classification, appraisal and survey of this country and the subsequent construction of roads, planning of farms, construction of buildings, fencing and water supplies and the operation of clearing and preparing the land for pastures, sowing, makes an interesting and creditable story of land development. This has been made possible by the employment of equipment and organisation with adequate finance to ensure that a large number of farms will be brought to a highly productive stage in a short space of time, and that facilities and amenities of a modern farming community will follow without undue delay.

It was logical to develop, as the first venture, the Mt. Manypeaks area as that lying closest to the port of Albany with

its existing facilities, and for some years now, all the farms contained in the area of the original soil survey conducted by the Department of Agriculture, have been occupied.

With its 30 in. of annual rainfall, 8¾ months growing period and good soil types, the farm size has been determined as smaller than that required for the South Stirling area and others such as Jerramungup and Gairdner.

The development of these areas has also stimulated the development by private persons of farms situated in the intermediate areas north, south and east of the Stirling Ranges.

At present also, extensive private development is taking place near Hopetoun and in the large tract of country referred to as the Esperance Downs. Information has been made available from experience at the Departmental Research Station at Esperance and much of this is applicable to the problems of development and future farming of our South coast areas.

The most recent area of about a third of a million acres on which large-scale development has been commenced by the Land Settlement Board is that lying east of the Coracherup Creek and west of the Gairdner River, extending south from Jerramungup to the Bremer Bay road. This project area, some 25 to 45 miles south-east of Ongerup is, in effect, an extension of the Jerramungup project where surrounding light land was developed in conjunction with the heavier land on a repurchased estate. The organisation established for Jerramungup has been extended into the Gairdner project where 100 farms are in the process of developing into ex-servicemen's properties.

The annual rainfall ranges from 16 in. to 22 in. and this factor has determined that the area of pasture developed per farm should vary from 1,800 acres down to 1,200 acres. The soil types developed are those mainly with a sandy surface and with clay within 2 ft. of the surface, and often, at much shallower depths. After the initial design of sub-division was prepared and while the surveying was in process, a complete road system was constructed in the area and the development of the individual farms proceeded according to the information which had been made available by the Department of Agriculture and the large-scale experience of the Land Settlement Board.

The development of farms is directed towards making them mainly grazing properties and the establishment of clover and grass pastures for the running of sheep for meat and wool and some beef cattle.

The light scrub on the plain was knocked over during late spring by dragging heavy anchor chains, two tractors handling a swathe as wide as four chains in some situations. This is followed by burning the dead scrub in the late summer to ensure the thorough removal of the surface debris. Later, the ground was thoroughly ploughed to a depth of 4 in., sufficient to get below the main root system of the scrub and facilitate its more complete removal.

This ploughing was undertaken as early fallow so as to ensure that a resting period would intervene before planting in the autumn of the following year. Experience has shown that without this long fallow period, it is difficult to obtain an adequate removal of the fine scrub root material. Also even if the land is brought to a satisfactory tilth, considerable loss is still sustained with the young clover plants after they have germinated.

In the Gairdner project, if the fallow has not been ploughed sufficiently early in the preceding winter, it is left for a further year as two-year fallow before the seed is planted.

The basic pasture plant is subterranean clover and the southern portion of the project lends itself to the utilisation of a midseason variety such as Bacchus Marsh, the northern portion being planted with the early variety Dwalganup. On the farms midway between these two zones a mixture of these two varieties of clover is planted to ensure that there will be a survival through the early variety and under favourable conditions, the greater growth will be obtained from the later and slower-growing variety.

In common with many of our sandplain soils, it is necessary to apply not only heavy dressings of superphosphate but the trace elements copper and zinc, the initial fertiliser on this project being a bag per

acre of superphosphate mixed with copper and zinc. The following year at least 150 lb. per acre of superphosphate is applied.

The clover is planted at the rate of 6 lb. per acre and a small quantity of Wimmera ryegrass as low as ¼ lb. per acre is also included to ensure that in later years, this will help to make up the sward and balance the pasture.

The planting is carried out by means of disc drills fitted with the small seed attachment, each 24-run drill planting 1,400 acres per season.

Last year 80,000 acres of pasture were thus established thoroughly and well on good fallow, and a special field day conducted by the Gnowangerup Road Board provided an opportunity for farmers to inspect the area and view the undeniable success of the establishment of these pastures over extensive areas.

A similar area of land, that is 80,000 acres, is under fallow and being worked in preparation for an early start for the season of this coming year. Side by side of this development the business of constructing fences, houses, sheds and dams is proceeding. Water catchment has been facilitated by the large extensive use of roaded catchment areas so as to ensure that even comparatively light falls of rain will contribute towards the catchment in the dams.

The Gairdner project provides an object lesson for organisation and thorough execution based on sound knowledge and appreciation of the technical aspects of what is required for this class of country. Even on these newly developed areas, the Department of Agriculture has its experimental plots to determine the problems which will arise in the early years of production.

The results there leave no doubt that the successful development of light land in the southern parts of the State can be successfully accomplished and substantial numbers of stock may be carried in a comparatively short space of time provided the appropriate recommended methods of development are employed.

THE USE OF HORMONES IN VITICULTURE

By L. T. JONES, Senior Plant Research Officer

THE discovery and proper use of plant hormones, or as they are more accurately termed, growth-regulating substances, probably represents the greatest contribution which science has made to agriculture in the past few decades. It was the discovery by Kogl in 1934 that indole acetic acid was an active growth substance which led rapidly to the preparation and testing of large numbers of compounds of similar chemical structure and among these were found many substances which were very potent and also comparatively cheap to produce.

The remarkable property of these materials is their great potency. They are capable of exerting profound physiological effects when applied to plants at concentrations of only a few parts per million.

By the use of these so-called plant hormones we are able to hold blossoms on, take blossoms off, prevent pre-harvest fruit drop, hasten maturity, delay maturity, hasten rooting, prevent sprouting, kill weeds and trees and improve fruiting. Although weed control accounts for the largest use of these materials our particular interest is in the sphere of fruit setting.

FRUIT SETTING

For the flowers of most plants to develop fruit, pollination and fertilisation must occur. As a result the embryonic fruit becomes a centre for the production and accumulation of the natural fruit-setting hormones. The failure to obtain good fruit setting may be due to the inadequate production of the natural fruit-setting hormones. In such instances certain synthetic growth-regulators applied to the flowers may correct the deficiency of natural hormones.

In this field one of our research projects was to determine a satisfactory and

safe commercial technique for the setting of the fruit of the currant grape vine using a hormone spray. I will now deal with this in more detail.

Fruit Setting in Currant Vines.

The cincturing of currant grape vines at flowering time has been adopted as the standard method for improving fruit set since its introduction from Greece into Australia by Catton-Grasby in 1897.

An important commercial characteristic of currant fruit is that it is normally seedless. Therefore, in the absence of seeds, cincturing is necessary to induce a satisfactory berry size. Cincturing involves the complete removal of a narrow strip of bark from the stem of the vine when the grape flowers are in full bloom which locally would be early in November.

Because it was believed that cincturing was one of the factors involved in the deterioration of currant vines in the Swan Valley, trials were commenced in 1951 to work out a satisfactory commercial technique of applying two selected materials, namely 2,4-D and PCPA. Earlier work elsewhere had indicated that these two hormones were those most likely to be successful. After two seasons it was possible to recommend with confidence a technique of application which could not only replace cincturing but was an improvement on the old method. Concisely the method was to spray PCAP at 20 parts per million, on the grape flowers in full bloom. It is only necessary to thoroughly wet the bunches. It is estimated that through the labour saved and extra production consequent from increased vine vigour, the commercial adoption of the hormone spray method has been worth £50,000 annually to local currant growers. It is interesting to record that the method was so well received that within two seasons hormone spray had practically replaced cincturing in the Swan Valley. I think it can be fairly claimed that local Departmental research has played an important part in working out a safe and satisfactory technique and thereby hastening the adoption of the method both locally and throughout the Commonwealth.

Gibberellic Acid.

Last November a new material called gibberellic acid was used locally mainly as a possible replacement for PCPA on the setting of currants. It was also tried on some table grapes, which contain seeds, to test whether it would increase the size of the berry and the bunch.

It has been known for some 30 years that a metabolic product of the fungus *Gibberella fujikuroi* which is responsible for a soil-borne disease of rice, has a striking effect on plant growth. It was observed that many infected seedlings grew taller than the healthy plants.

This fungus was cultured, and finally one of the three related active compounds namely gibberellic acid was obtained in pure form. Some workers have put forward a guarded case in favour of gibberellic acid being akin to, if not, actually a natural plant hormone. This material (G.A.) can now be produced commercially by the same fermentation methods used industrially for the production of such antibiotics as penicillin and streptomycin. The present price appears to be about £100 to £250 an ounce but it is a very potent material and the cost must come down as sales increase. Fantastic claims have been reported of the effects of gibberellic acid but the true potential of this new agricultural tool has yet to be determined. At this early stage no assured major crop use can be noted but the indications are that gibberellic acid may soon have some commercial uses. At present we can only indicate possible promising fields such as stem elongation, increased yields, dormancy breaking and flowering and fruit-setting effects.

The pronounced fruit-setting ability of gibberellic acid is of interest both economically and physiologically. There has been a continual search for better growth regulators to replace a variety of chemicals which, commercially and experimentally, have only been partially satisfactory. The perfect material should be harmless and should be effective over a wide range of concentrations.

It was with these objects in mind that gibberellic acid was used on the varieties Early Madeleine and Zante Currant to replace PCPA for fruit-setting in these seedless grapes. The results were substantially the same in both varieties.

The material was used in these exploratory trials at the very low concentrations of one-half and two parts million. Gibberellic acid was sprayed on the bunches at about the time of full bloom. At first both concentrations had a marked effect in increasing berry size but the effect did not continue at the same rate and finally 2 p.p.m. was better than ½ p.p.m. The berry size was finally inferior to cincturing or hormone spray but definitely superior to no treatment at all. These results point to gibberellic acid being of value in fruit-setting in seedless grapes. Next season we plan to increase the concentration to 10 and 50 p.p.m. and expect that in the light of recently published Californian work better results should be obtained.

However it should be mentioned that, probably due to vine vigour and climatic factors, fruit-setting in currants this season was abnormally difficult and this may have affected our experimental results.

It has been recorded that while gibberellic acid may stimulate top growth it does not similarly stimulate root growth. Our experience of moisture stress on vines at two sites being induced by treatment with gibberellic acid would suggest that this possible harmful effect will need to be watched in the future. Some seeded table grapes (namely Red Prince, Ohanez and Waltham Cross) were also treated with the same low concentrations of gibberellic acid. The results were inconsistent but in two out of three sites there was obtained bigger berries, and larger bunches and a tendency to earlier maturity. Such results show that when the techniques are mastered there could be quite a promising future for the use of gibberellic acid in viticulture.

Vine Killing with 2,4,5-T.

It was thought at one stage that there may be a use for hormone killing of old vines before replanting. The method used was the same as that used to kill the Mesquite tree which is such a problem in parts of our North-West. The basal 9 in. of the vine was sprayed with a solution of 1 lb. of acid equivalent of 2,4,5-T ester in 10 gallons of diesolene.

It was found that, judged from final effects, vines may be treated at any time of the year and there is no advantage from "frilling."

However the method appears to have only a limited application in vineyards because it is usually no cheaper than normal methods and there is always the danger of hormone damage to surrounding vines from drifting vapour and contaminated equipment.

RECENT TRENDS IN VITICULTURE IN WESTERN AUSTRALIA

By W. R. JAMIESON, Viticulturist, Department of Agriculture, Perth

TODAY I want to talk very briefly about some of the more recent trends in viticulture in this State. The commercial production of grapevines is centred mainly around the Swan Valley and as most of the suitable vineyard land in this area has been planted, growers are exploring avenues to increase the returns per acre.

This has led to the following results:—

(1) The replanting of vineyards with more popular varieties.

(2) More satisfactory disease control.

(3) A more extensive use of irrigation.

Let us consider each point in more detail.

Replanting.

On the fertile banks of the Swan River there is a tendency to replant land growing currant vines with table or export varieties. This is not a violent trend as many growers have a reluctance to rely solely on the fresh fruit market. There is also considerable money invested in drying racks and trays, and replanting

with other varieties is not warranted before the currant vines have reached the end of their economic life.

On less fertile soils, the trend has been to replant with early fresh fruit varieties or else with wine grapes. In this regard, I would point out that the wine grape variety, Grenache, is overplanted in relation to other wine varieties, and growers are strongly advised to plant on suitable soils, Shiraz, Pedro and perhaps Semillon.

Disease Control.

Diseases of grapevines are much more efficiently controlled than formerly. The research work of the Department of Agriculture leading to the use of Ziram as a fungicide against black spot or anthracnose has given benefits impossible to estimate.

Sulphur is still the best protection against Oidium or powdery mildew but it is more commonly realised that it is essential to commence sulphur sprays or dusts early in the season when the shoots are two to four inches long and to follow this up with another two or three applications at regular intervals.

Vignerons are fully aware of the possibility that nematode and other soil-borne parasites may be lowering the vigor of their vines on very sandy soils. Preliminary work has indicated that the hybrid rootstock, Teleki, may be an advantage on such soils.

Fortunately, only a few vines in this State show typical symptoms of "degeneration" the most serious virus disease of vines. It is only spread by cuttings and most growers realise the necessity to select cuttings for propagation from vigorous, fruitful vines. These vines should be marked with a dab of paint in the Springtime to allow easy and positive recognition during the pruning season.

The Irrigation of Grapevines.

There has been a great exploitation of underground water supplies and a spectacular increase in the irrigation of vines during recent years.

Though irrigation is desirable, indeed necessary for heavy production of late table grapes, I would strongly urge the utmost caution in its application.

Generally speaking, our soils are not ideally suited for irrigation, and therefore care and attention during watering and a thorough understanding of the principles of irrigation are absolutely essential.

The adverse effects of excessive or untimely irrigation can be very serious. Not only is the soil structure destroyed but the soluble nutrients are leached from the soil and with the rise in the water table, salt tends to accumulate near the surface.

If the deeper roots are subject to waterlogging during the growing period they will die and this leads to the formation of a shallow-rooted vine.

Finally, irrigation should be kept to a minimum during the ripening stage of the grapes, otherwise the sugar content of the fruit is affected and maturation delayed.

METHODS OF IRRIGATION

By G. GAUNTLETT, Assistant Officer-in-Charge, Irrigation

THE success of an irrigation scheme depends on several factors. Important among these is the choice and design of the method to be adopted. There are two methods of irrigation, viz., surface and spray irrigation.

The surface system consists of a head channel from which water is led into furrows or borders. The head channel must be large enough to carry the required amount of water and will contain certain structures in the form of checks and outlets. For surface irrigation it is essential that the land be graded prior to watering. This may cost from £4 to £25 per acre with an average cost of perhaps £10 per acre. Grading is also necessary for efficient drainage which is a necessity with any irrigation set-up.

The surface system can make use of large quantities of water and is suitable for all crops. It is applicable to all soils

except those soils which have an extremely high or extremely low intake rate. Slopes of up to 3 per cent. can be safely irrigated.

If the system is to be watered gravitationally the highest land to be irrigated should be at least 9 in. below the water level at the supply point.

The spray or sprinkler system consists of a power unit, pump, main pipe line, laterals and spray beads. The laterals may be either fixed or movable.

This system is more costly to instal and can cost between £30 and £150 per acre. However, expensive grading is not so important and steeper slopes can be irrigated.

With the sprinkler system, greater control is exercised over the application of water and much smaller supplies can be used. Valuable land is not absorbed by head channels and a surface distributory system.

Labour costs are only slightly higher in this system.

Both systems should be well designed and a survey made of the area to be irrigated and the design worked out on paper first.

To briefly summarise the above.

1. If there is an adequate water supply, say of the order of 20,000 gallons per hour, and grading is a practical proposition then the surface system should be adopted.

2. If the supply is limited and grading is impracticable or too costly then the spray system should be used.

CANKER DISEASE OF RED-FLOWERED GUM

By W. P. CASS SMITH, B.Sc. (Agric.), Government Plant Pathologist

OF the many beautiful native plants in Western Australia, few are esteemed more than the red-flowered gum known botanically as Eucalyptus ficifolia. This shapely tree commences blossoming about Christmas time—and provides a magnificent display for several weeks—the blossom shades varying from dark red to pink.

Formerly, the red-flowered gum was widely planted here in streets and home-gardens, but unfortunately it has been attacked by a canker disease, which has destroyed large numbers of trees in many parts of the State.

The symptoms of this disease are characteristic. Cankers develop on the branches, or the trunk, and the first sign of their presence is a splitting of the bark, together with a coating of white powdery material on the underlying wood. The cankers gradually enlarge until the branch is girdled, when the distal portions wilt and die.

Small branches may be girdled and killed by the cankers in a matter of weeks, whereas when the main trunk is attacked, several years may elapse before the tree dies.

Work by the Department of Agriculture has shown that the disease is caused by a new species of fungus which is unknown in any other part of the world.

The fungus is spread by means of its seeds or spores, which are produced abundantly on the surface of the cankers, and which, in mass, appear white and powdery.

New infections can only take place through the medium of wounds, which are commonly provided by the cutting back of trees in street plantings, or the breaking-off of flowering branches.

In home gardens, where only a few trees are grown, the surgical removal of cankered branches, together with applications of fungicidal spray may prolong the life of infected trees for many years; but in street plantings, these control methods are generally considered to be impracticable.

For this reason, search has been made for disease-resistant trees, and by means of artificial infection experiments, it has been found that while the majority of red-flowered gums are very susceptible, a limited number are highly resistant or immune.

Now if these resistant trees could be propagated vegetatively, by stem cuttings or grafts, the canker disease could be readily controlled—but unfortunately this method has not yet proved possible.

Control by cross-breeding is therefore being attempted, but this is a lengthy task which involves artificial transfer of pollen from one resistant tree to another, under insect-proof conditions.

First generation, hybrid seedlings produced in this way have been planted in an isolated area at the Gnangara Pine Plantation and inoculated with a culture of the canker-causing fungus. A percentage of these seedlings show resistance to the disease and when large enough, the best specimens will again be artificially pollinated to produce a second hybrid generation.

Ultimately, by cross-breeding and selection in this way for several generations, it is hoped that supplies of seed will be obtained, which will breed true to type and give a high percentage of resistant seedlings.

Now finally, a word about the origin of this disease may be of interest.

As the causal fungus is a new species unrecorded elsewhere in the world, it must be indigenous to Western Australia.

However, in the Nornalup-Walpole area, which is the native home of the red-flowered gum, the disease has never been found—and one certainly would expect to find it there if it had originated on this species.

Where then did it come from? The answer was not obtained until other trees were tested experimentally, when it was shown that the native red-gum or marri is also susceptible to the same disease.

Subsequently, naturally-infected marri trees have been discovered in many localities in our lower South-West—miles away from any red-flowered gums.

There is little doubt therefore that the canker disease originated on the marri, and spread to red-flowered gums, when the latter species was grown away from its native home.

WHY MANY BEANS GROW CROOKED

By M. HARDIE, Vegetable Instructor

SOMETIMES in the process of growing a crop, bean growers find a number of pods which, instead of being long and straight and suitable for marketing, are crooked or bent and quite unsuitable for sale unless beans are in very short supply. It is not unusual for a small number of pods to be affected in this way, generally at the tail-end of the crop, but occasionally the percentage may be high. When this happens the grower is often at a loss to account for his failure to grow a marketable crop. To the best of his ability he has followed methods which normally return a crop of first-grade pods and yet for some reason, his crop is an unpayable one and he is anxious to ascertain the cause.

Bean flowers are self-fertilising, and pollination usually takes place just before the flower opens. Under ideal conditions, complete fertilisation of the ovules or undeveloped seeds is effected and normal growth of the seeds and pod follows. The bean is then ready for picking in two to four weeks, depending on seasonal conditions. If none of the ovules are fertilised and there is no seed development, the tiny pods usually turn yellow, wither, and fall off. This is commonly called "flower drop" and has no doubt, been experienced by both commercial and home-garden growers at some time or other.

When there is interference with pollination, some of the ovules may not be fertilised and consequently, do not develop, whilst those which have been fertilised grow normally. Each pod usually contains from six to ten seeds and if only one or perhaps two are undeveloped, it is still possible to obtain a marketable pod. However, when there is more than this number unfertilised, then the bean usually develops an abnormal shape which makes it unsuitable for marketing. The most troublesome condition is when only one or two ovules are fertilised, because even if only one seed develops the

pod will have the required stimulation to remain on the plant and continue to grow though its shape will not be normal.

When only one or two seeds develop they are usually at the end of the pod farthest from the stem and, conversely, those which most often fail to be fertilised are at the stem end. Occasionally, one or two seeds in the centre of the pod may not develop and when this happens the pod becomes bent at a sharp angle at the middle and is considered a cull.

To the market gardener whose livelihood depends on his ability to grow beans of good quality, it is important to know what causes this abnormality and what can be done about it.

Undoubtedly the factor which causes most of the trouble is temperature. Even though temperatures are not low enough to cause damage to the plant itself, prolonged low temperatures or cold drying winds at flowering time will adversely affect the crop. Many of the flowers may set pods but the seeds will not develop and the pods will be dwarfed or curved. Similarly, where beans are exposed to abnormally high temperatures, the pollen is either destroyed or fertilisation of the ovules is faulty and abnormalities result. Critical temperatures at which damage occurs to the varieties grown here have not been ascertained but generally when temperatures approach the hundred degree mark and the humidity is low, damage results.

The soil moisture level is also an important factor as hot, dry winds which cause a temporary moisture stress in the plants can also cause a heavy flower drop or serious distortion of the young beans which are setting at that particular time. In addition, pods which develop on spurs that are fully exposed to the effects of wind and sun are often noted to be thickened or otherwise poorly shaped because of incomplete pollination. This is particularly noticeable on the outside rows of a patch of beans.

Another very important casual factor is the feeding of insects within the blossom before pollination is completed. At this stage, the miniature pod is very easily injured by the rasping feeding action of thrips which are often found within the flower. Damage from this cause can sometimes be very puzzling as unless a very close scrutiny is made, the presence of such tiny insects may easily be overlooked.

"SALT LAND—PROGRAMME FOR AUTUMN"

By T. C. STONEMAN, Adviser, Soil Conservation Service

NOW that summer is over and winter approaches, the time has come to decide what you'll do with that salt problem on your farm. What you SHOULD do, will depend on how severely the area is affected. To make quite clear how the recommendations made by the Department of Agriculture can be applied I will deal with each degree of severity in turn.

Firstly any area where you've noticed that short stunted type of barley-grass becoming dominant over the other native grasses should be treated with suspicion because this is usually an indication that the spot is becoming salt-affected. These areas and the somewhat worse ones in which up to about one-third or even one-half of the area is taken up with bare patches should be approached in the same way. They can best be tackled by sowing in oats, or barley, and early strain Wimmera ryegrass as a scratched in crop. This can either be sown dry or soon after the opening rains. It is quite important not to seed them too long after the opening rains—the aim is not to get a clean crop, but rather the reverse, that is to avoid killing any of the native salt-tolerant grasses. But the areas shouldn't be left out as the super and cultivation improve the plant cover.

Secondly, on the more severely salt-affected areas which are not, however, completely bare, the easiest and most effective approach is to cultivate the area very roughly as soon as possible—the idea of this is merely to improve rainfall pene-

tration and hence leaching down of salt when the opening rains begin and to catch windblown seeds of such native salt-tolerant plants as *Spergularia*, curly ryegrass, barley-grass, bluebush and the various saltbushes.

Also, on this type of area, it would be worthwhile trying a seeding of creeping and Old Man saltbush. These seeds are available commercially at the moment from at least one of the major stock firms. So far our knowledge of seeding techniques and rates for these plants is a bit sketchy, but we do know that successful stands can be established by mixing the seeds with super in a combine and seeding onto the surface of cultivated soil with or without a very light covering with harrows. It appears to be important that the seeds should not be buried deeper than about half an inch. As for seeding rates, we would suggest something in the order of about 2 lb. to the acre. These salt-tolerant perennials can be sown anytime between now and about July, care being taken, as mentioned earlier, to avoid killing the barley-grass by late cultivating.

The "cultivation only" approach is also used for the almost completely bare, severely salt-affected areas. The reclamation of these types of salt "problem areas" is still very dependent on encouraging plant colonisation of the area by trapping windblown seeds of native salt-tolerant plants.

If you have any areas you're seriously concerned about, now might be an opportune time to emphasise the importance of fencing off salt-affected areas from the remainder of the paddock. This is the only way these problem areas can receive the separate and special management they need. It is essential for salt-affected areas of all degrees of severity that plant growth be encouraged and this implies that overgrazing, late cultivation and fallowing must be avoided.

This last point—the avoidance of fallowing is one which will be well worthwhile keeping in mind later in the season. In any area already salt-affected or any situation that you think could become salt-affected, it is a sound safety precaution not to fallow.

To summarise these points as they relate to this autumn and winter:—

A scratched crop of oats or barley and early strain Wimmera ryegrass should be sown on to slightly salt-affected areas.

It is important that any such seeding should not be carried out very long after the opening rains to avoid killing natural grass.

More seriously salt-affected areas will benefit from a cultivation aimed at producing a rough surface—this can be carried out anytime between now and soon after the opening rains.

Fencing off of salt-affected areas is one of the most important factors in their reclamation.

Finally, overgrazing and fallowing must be avoided.

ORCHARD COVER CROPS

By J. CRIPPS, Horticultural Adviser

THE sowing of a cover crop is one of those routine operations which the orchardist often undertakes without much thought, but it is an operation worthy of consideration.

Why is a cover crop sown? Firstly to add organic matter to the soil with the intention of improving soil structure and retaining moisture. Secondly to stop erosion by preventing soil movement and thirdly to add nitrogen to the soil.

Generally speaking, a volunteer weed crop does not add much organic matter to the soil, since the volume of plant material available for turning in at the end of winter is small and contains a high percentage of moisture. The sowing of a cover crop is preferable and should be regarded as good orchard husbandry.

What cover crops are available? New Zealand blue lupins come to mind first but oats and subterranean clover are alternatives which should be considered.

The lupin has been grown because it adds some nitrogen to the soil and can be disced in early spring, before it can compete with the trees for moisture. The disadvantages of a lupin cover crop are felt to be that it is liable to slug damage, it has to be sown early in the autumn and seed is expensive.

It is usual to sow one bushel of lupin seed to the acre, but a better stand often results from an increase in the seeding rate to 1½ bushels per acre. Dry seeding may be practised, that is the seed may be sown before the first rains. The area to be sown should be dressed with superphosphate at one bag per acre.

Oats are a possible alternative too and have some advantages over lupins. For instance they can be sown later and seed is relatively cheap. On the other hand, no nitrogen is added to the soil, although this may not be a serious drawback. The soil in which oats are to be sown should receive a dressing of super as for lupins, and the Algerian variety is possibly the most suitable and is sown at 60 lb. to the acre. In general, I do not think that it is advisable to economise in cover crop seed.

Oats add a considerable quantity of organic matter to the soil; indeed in an experiment carried out last winter, the average dry weight harvested from plots of oats was greater than that obtained from plots of lupins. Some difficulty has been experienced in turning in an oat crop, but I do not think that the leaving of a proportion of a cover crop on the surface is any great disadvantage since it will be buried during later cultivation.

Subterranean clover has not been tried extensively in orchards but it has the advantage of probably increasing soil nitrogen more than any other cover crop and is less subject to slug damage than are lupins. Seed should be sown at 10 to 20 lb. to the acre if the crop has not been established previously, and should be innoculated. Super at up to 2 cwts. per acre must be applied when the crop is sown if a satisfactory establishment is to be assured. Yarloop seems to be the best variety so far tried.

If this crop is left to seed down it may compete with the trees for moisture and to overcome this it is suggested that it be cultivated in at the same time as other cover crops and resown the following autumn, 5 lb. of seed to the acre being sufficient.

On the other hand limited reseeding may be achieved by cultivating one way and leaving strips of clover to seed down.

Lastly is there any alternative to summer cultivation and winter cover crops? I think that there is, although the possible alternatives are still largely in the experimental stage. One of these is a sawdust mulch and this was applied to a small area of two apple orchards in the hills almost three years ago by the Department. Results so far have been quite good, moisture has been conserved, weeds smothered, the trees have cropped heavily and the mulch has remained in position. The main drawback would appear to be the high initial cost and the heavy dressing of nitrogen, up to half a ton of sulphate of ammonia per acre, which must be given in the first year. This dressing can be reduced by at least 50 per cent. in subsequent years. The advantages are that no cultivation and less irrigation are necessary and that a greater volume of soil is made available to the tree roots. Anyone wishing to try this type of soil management should contact the Department for advice before proceeding.

It is, I think, evident from what I have said, that there are several possible orchard cover crops and that careful consideration should always precede the decision to sow any particular one.

LUPIN SEED

By B. J. QUINLIVAN, B.Sc. (Agric.), Botanist, Weeds and Seeds Branch

THE three types of lupins which we grow in this State are the New Zealand, the W.A. blue, and the yellow lupin. The first two types are very common, the New Zealand lupin being grown mainly in the South-West, while the W.A. lupin is grown over extensive areas of the central and northern wheatbelt, particularly on the sandier types of soil.

The yellow lupin is a roadside weed in parts of the South-West, and is cultivated by a few farmers who believe that it is superior to the New Zealand lupin. Frequently this type is referred to as the "Sweet" yellow lupin—this is very much a misnomer. The sweetness or bitterness of the seed varies according to its alkaloid content. In Europe, where lupins are extensively grown, seeds with an alkaloid content higher than 0.1 per cent. are normally looked upon as "bitter." The sweet strains of lupin, which they grow, have very low alkaloid contents down to .01 per cent. The yellow lupins growing wild and under cultivation in this State have alkaloid contents around the 1.5 to 2.0 per cent. mark and are very much a "bitter" type. As regards other aspects they do not compare favourably with the New Zealand lupin and can hardly be recommended for planting. The genuine German "Weiko" strain of sweet yellow lupin is under trial at some of the Research Stations but so far is not very promising.

New Zealand blue lupins have been grown in our South-West for many years. They have been used mainly as summer stock feed or as a green manure crop in orchards. Up to fairly recently, most of the seed was imported from the Eastern States or New Zealand. A very pleasing feature over the last three years has been the rapid increase in locally-produced seed. Over 200 tons per annum are produced, and the State is now virtually self sufficient. Although harvesting New Zealand lupin seed is by no means straight-forward, the general quality of the locally-produced seed is good, and compares favourably with imported seed. There is obviously plenty of opportunity for increasing the production of this particular type of seed—the main limiting factor being the rather variable wholesale prices being offered.

The West Australian blue lupin is widely grown, and is a very important pasture plant, particularly on many of our sandy soils. From a seed production side however the position is far from satisfactory. Up to a few years ago it was not unusual to find lines of seed being offered for sale with up to 80 per cent. dead seeds. More recently the use of the Oliver specific gravity graders has enabled the dead seed content to be lowered but even so most lines still have between 30 to 40 per cent. dead seed. Of the viable seed in the samples only 20-30 per cent. germinate, the remainder being hard seeds.

To say that West Australian lupins are a difficult crop to harvest is an understatement. The extremely uneven ripening, and the necessity to thoroughly dry the seed immediately after harvest make the production of a high-germinating line virtually impossible. Experiments aiming to improve the general quality of the seed have been carried out both by the Department and by the Institute of Agriculture over the last few years.

The study of the hard seed content of this particular species has produced some rather interesting results. It appears that West Australian lupins have no natural hard seededness, and, with hand-harvested seed almost 100 per cent. emergence is possible if the seeds are germinated immediately after harvesting in November or December. However, as the seeds lose ther moisture during the dry summer, they become hard; and by March the following year the same seed will only give a germination of 10 per cent. or less. If, however, such seed is kept in an air-tight container, it will retain its high germination right through the summer.

This is interesting, but as yet, is of little practical significance as very little commercial seed is hand-harvested. The main difficulty with seed harvesting in the

normal way with a header or an Allcrop harvester is the uneven ripening with the subsequent high percentage of dead seeds in the sample. In the United States chemical defoliants are used on some crops to obtain uniform ripening, and over the last few years we have been testing a number of these chemicals on the West Australian lupin. Some have dried off all the foliage and for this reason alone would possibly be of some use, but no chemical so far has produced any significant improvement in the uniformity of seed ripening.

CEREAL RYE WILL GROW ON WIND-ERODED AREAS

By G. H. BURVILL, Chief Plant Research Officer.

TRAVELLING around the wheatbelt, one often sees areas of sandy soil quite bare, due to wind erosion. Surface soil blown from these patches has built up against fences, or as mounds in the nearby scrub. Many of the eroded places are quite small—perhaps less than an acre or only a few acres. But some are large, with one to three hundred acres of bare yellow sand. As much as two feet of soil has been blown from big areas.

This wind erosion trouble is seldom a major problem on a single farm. It attracts little attention from farmers or the public unless the patches are large and the drift sand affects adjacent roads or neighbouring properties. Yet the affected areas are not difficult to cure **if action is taken before they become too large.** Cereal rye will grow on these wind eroded areas.

Recently I have flown over parts of the wheatbelt, and from what I saw from the plane, I am convinced that there are more sand drifts and bare wind-eroded areas than there need be. Farmers with light lands which show any tendency to drift badly should not fallow such patches, even if the remainder of a paddock is being fallowed. Often a farmer says that a sand drift started in a particularly windy period when a paddock was fallowed. Then the drift continues because the fertile topsoil has gone and any crop planted on it, or any volunteer weeds or pasture makes very sparse growth. Any plants which do grow are sandblasted by drifting surface soil.

Cereal rye is a remarkably tough plant both as a seedling and when mature. Many of you can still remember that tough rye straw was used as padding in horse collars. The seedlings, even when only a few inches high, can survive sandblast which destroys wheat, oats, or barley. Roots of rye seedlings can be exposed by sand drifting away, without killing the plant.

I refer to this plant as cereal rye to avoid any confusion with Wimmera ryegrass. Cereal rye or rye corn is the cereal from which the so-called black bread of Europe is made.

Wind-eroded areas of sandy soil deserve special treatment before they increase in size. They may need to be fenced off as well as planted with rye. The banks of piled-up sand will grow rye three to six feet high if it is sown with superphosphate and not grazed. On the blown-out parts, rye with only super may grow only a foot tall. But experiments in recent years both in Western Australia and South Australia have shown that very good growth can be obtained on the wind scoured areas if ammonium sulphate as well as super is used as fertiliser. The nitrogen from the ammonia is necessary, as all the surface soil and humus have been blown away.

Here then is the way to handle your wind-scoured and sand-drift areas. Plant after good autumn rains, with a disc drill or combine 40 to 60 lb. per acre of cereal rye seed. On the wind-scoured, blown-out areas use a mixture of super and sulphate of ammonia which will provide 28 to 56 lb. of sulphate of ammonia per acre. That means use a hundredweight of a three to one or one to one mixture of super and ammonia. On the banks of drift sand, super by itself at normal rates will be sufficient fertiliser. Fence the affected area if necessary to allow the rye to grow to maturity. Do not stock the area till late in the following summer. At this time, some breaking down of the crop to shed seed, and to trample in seed, may assist in giving a better growth in the second year. In the third year, consider introducing lupins or subterranean clover.

At all times remember that to check soil erosion by wind a cover of living or dead plant material on the surface is required.

If you have wind-scoured patches do not delay in starting a reclamation programme.

AUTUMN-WINTER FEEDING FOR THE FAT LAMB FLOCK

By N. DAVENPORT, Senior Adviser, Meat Production

THE autumn-winter period is the most important part of the year for the fat lamb crop from a feed point of view. It is important not only from the aspect of the wellbeing of the sheep, but also of the pasture. Pasture plants are living things, too, and they also require consideration and care for their development. When a new season pasture is kept hard grazed in those critical first few weeks of growth it cannot carry as many sheep over the season as one which is lightly stocked during that time.

Paddock feed in the autumn is usually quite inadequate for the pregnant ewe close to lambing. Paddocks generally are in that condition now. Ample additional feed must therefore be provided to "steam up" the ewe so that she will lamb normally and deliver strong, healthy lambs with minimum losses.

In many flocks, steaming up is already well under way but even if lambing as late as early June all flocks should now be receiving adequate supplement to prepare them for a safe and successful lambing.

A good deal of research has been carried out into the levels of feeding required to ensure a successful lambing. It should be such that the ewes gain in weight at least about 10 lb. and preferably more during the last third of pregnancy. This result can be achieved by feeding ¾-1 lb. of oats or an ounce or two less of wheat or barley per day according to the extent and value of the paddock grazing. If the paddocks are fairly bare 1 lb. of hay should be fed out as well. It is preferable to feed three times or even twice a week instead of daily, but the change over must be gradual. High quality meadow hay can replace grain, 2 lb. of hay for each pound of grain. Also silage can replace hay—3 lb. of silage to one of hay.

The aim of the lamb breeder is to have his lambs growing strongly and continuously from birth to marketing. For the first month to six weeks they are dependent entirely on the mothers' milk. It is obvious then that the ewes require to be well fed after lambing so that their milk

production will be ample. If early sown cereal crops are not available, or the pastures are not sufficiently developed for grazing, the supplementary feeding of the prelambing period should be continued but the rates increased by a third.

After the opening rains and until the pastures become well established is always a critical time in the feeding programme and the ewes should not be permitted to roam over large paddocks chasing that early bite as they are so prone to do. This results in deserted lambs which means dead lambs. Confining the ewes and lambs to restricted areas allows the main pastures to get away more quickly and so provides earlier paddock grazing.

In the young stage, when pastures are first ready for grazing the growth is lush and high in protein. Such a high protein diet is wasteful and the pasture can be used more efficiently by providing hay in addition. In view of its lower protein content, cereal hay is just as well suited if not more so for this purpose as good meadow hay.

With our annual type pastures there appears no advantage to be gained in actual pasture production by rotational grazing as against set stocking. However, in spite of this it is a very good practice to move the sheep periodically to fresh paddocks as they appear to do better and it is a valuable aid to worm control. Pasture should certainly not be grazed too short if this can be avoided. There is a mistaken idea that the sheep do better on the short bite, but it has been shown that this not so.

At about 12 weeks old those lambs which are not ready—and that will be a good proportion of them—should be weaned and finished on pasture alone. This will enable the ewes to be given restricted grazing, to get them in good store condition ready for flushing.

The lambs can then be assured of the best feed available prior to marketing.

Such a practice of early weaning means better use of feed. When the lambs are left on the ewes until marketed, the latter eat more than they require and get too fat. It is far better to keep them down in condition and have that extra feed available for summer grazing by mowing and leaving it in the paddock.

PLANT DISEASES IN THE HOME GARDEN

By W. P. CASS-SMITH, B.Sc. (Agric.), Government Plant Pathologist

RECENTLY many home-gardeners have complained that plantings of vegetables or ornamentals are making unthrifty growth, in spite of liberal waterings and fertilisation. These symptoms are commonly caused by root-knot eelworm, a pest which has unfortunately become very widespread in the sandy soils adjacent to Perth, and in many other parts of this State. This eelworm parasite attacks the roots of many kinds of plants causing them to rot and to develop bead-like swellings or galls. As a result, the intake of plant food and water is restricted and stunting of the above-ground parts occurs.

Soil which is infested with eelworm should be fumigated with DD or EDB compounds before the next crop is planted, and the improvement in growth resulting from this treatment is often spectacular.

Unfortunately, both DD and EDB are too damaging for application to living plants, but tests with a new fumigant named Nemagon, which is said to be safe for this purpose, are giving promising results.

Home gardeners who take a pride in their lawns are often puzzled by the rather sudden development of withered areas, which do not recover even with heavy watering.

This trouble which is usually referred to as **turf brown patch,** is caused by certain soil-inhabiting fungi and it is generally

most prevalent during autumn and early summer, when the weather is warm and humid.

As a result of this fungal attack the rotted grass tends to form a scum over the surface of the affected patch, which water-proofs the soil.

Remedial treatment should be commenced when the patches first become evident, and it comprises—pricking the soil with a tyned fork to a depth of two to three inches to aid water penetration; and applying a fungicidal drench at fortnightly intervals, until the grass recovers. There are a number of proprietary turf fungicides suitable for this purpose which may be obtained from seedsmen.

A comparatively new disease to Western Australia and one which is proving very devastating is the rust which attacks snapdragons. This disease was first recorded in New South Wales about six years ago and it rapidly spread to all States of the Commonwealth and to New Zealand.

The rust becomes obvious by the appearance of yellow spots and reddish-brown spore pustules on the leaves, and it causes blighting of foliage and often death of plants. Snapdragon rust may be controlled to some extent by spraying, and zineb-type fungicides are the most effective for this purpose.

Two snapdragon varieties which are said to have some resistance to the rust are Pink Freedom and University of California Rust-Proof, and although we have not yet tested these varieties, they may be worth a trial.

Turning lastly to citrus it is noteworthy that citrus trees may benefit considerably from a copper-containing spray applied in April or early May, before the winter rains commence. This spray will have a tonic effect on trees growing in copper-deficient soils and it will help to prevent the serious citrus brown rot disease which causes a blighting of leaves and rotting of fruits.

Bordeaux mixture or copper oxychloride are suitable materials and they should be thoroughly applied both to the trees, and the soil under the branches.

Persons interested in these plant diseases may obtain additional information from the Department of Agriculture.

PRINCIPLES OF COMMERCIAL BEEKEEPING

By R. S. COLEMAN, R.D.A., Government Apiculturist

WE have many queries from small beekeepers, and from people who have never opened a hive, on how to break into full-time beekeeping. So it was thought that you would like to know just what are the principles of successful bee farming.

There is an old saying which well expresses the kernel of the whole business: "Go into bees for money and you'll go broke. Go into bees because you like them and you'll make money." Remember that saying, because beekeeping is a way of life before it is a business. Once you are bitten (or should I say stung), the spell seldom lets you go. Now you see where the expression "Bees in your Bonnet" comes from.

It is obvious that first you must know something about bees. Learn from every available source and the best of the lot is your own hive.

Read every good book on beekeeping you can lay your hands on. Remember that experience and theory are the two legs that success stands upon. Each is almost useless without the other. The Department of Agriculture will help you with any advice you may need and with a list of textbooks. Two libraries lend textbooks on bees. One is the Adult Education Library and the other is the Library Board of W.A., through your local Road Board Library.

Once you have your basic knowledge of bees, three other things are necessary for success.

The first is the ability to work. Commercial beekeeping is hard work. Only a man who can work and has the ability to keep his mind on his job will succeed. The second is to have a sound business and organising head. All farmers must have these two qualifications for success, but the third and last is an added key to success in bee farming—knowledge of the nectar producing plants.

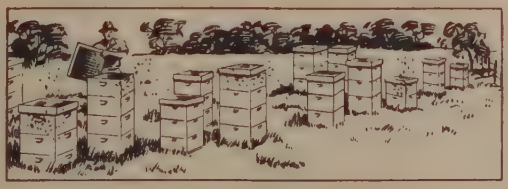
There is no point in keeping bees unless you gain a honey crop from them. This knowledge of the flora must be learnt mainly from experience, for although we can help considerably, your judgment must be developed from your study of the bush. We can tell you what plants to look for and where they are found and believe me, Western Australia has its fair share of honey-producing plants, far more than any other State in the Commonwealth. This is shown by the fact that the average production per productive hive in Western Australia was double the average of the productive hives in Australia, including Western Australia, for last year. The credit for this yield cannot be given entirely to the karri. The other States very seldom reach our average per hive and are usually 50 per cent, below.

Once the problem of finding the honey flow is covered, you will appreciate that the next thing is to get the maximum amount of honey from the flow. It is then that the need for high-producing stock appears. This depends upon two factors. First is proper management of the stocks so that they are ready to go to work as soon as the flowers start to yield nectar, and the other is a good strain of bees. Like all animals there are good high-producing strains in bees as well as very poor ones.

This was shown during the last karri flow where the better beekeepers averaged over 5 cwt. per hive, while beekeepers scattered amongst them only extracted between 1½ to 3 cwt. per hive.

When you start beekeeping it pays to keep good stock in your hives from the beginning as they cost the same to keep but the yield is consistently higher. These good strains of bees can be procured from any recognised queen breeder or some commercial beekeepers who may raise a few more queens than they actually need.

It does not matter what race of bees you have, as long as they are quiet and high-producing. When you introduce these good strains into your hives the next step is to learn how to raise queens to replace your old queens in your hives. There are many books written on queen raising, and if you care to write to me I will supply the titles, authors and where they can be obtained, together with remarks on each book. The next factor in high production is good combs. It is necessary to have the maximum amount of worker comb in your hive and only full depth foundation should be used as this cuts down the production of drone comb.



To actually start beekeeping, follow the example of the majority of our commercial beekeepers, by starting off with a few hives and increasing gradually. Three hives are the minimum to allow the efficient working of the bees. Check with your local Road Board first to see if you can keep them in your area. It is best to buy the hives as going concerns, or buy the equipment in the flat and put in small nucleus hives or swarms. As you gain experience, gradually extend. Try to make the bees pay for the expansion.

Remember that 20 hives are the minimum that will repay you for the labour and 80 are as many as can be handled, working over the weekend. It takes about 50 days per year to handle 40 hives properly and 200 hives is as much as one man can handle by himself, working full time.

GRASSHOPPERS AND LOCUSTS

By C. F. H. JENKINS, M.A., Government Entomologist

GRASSHOPPERS and locusts are among the most ancient enemies of mankind for they figured prominently in Biblical times, and periodically throughout the ages have devastated crops in all parts of the world.

The term grasshopper covers a wide range of insects differing greatly in size and habits, but characterised by the fact that they are vegetable feeders and have the hind legs especially developed for jumping. There are many different species of grasshoppers and locusts in Western Australia, but the difference between the two groups is not generally understood. When conditions are suitable, the species usually termed locusts are much more gregarious or social in their habits than grasshoppers, and may undertake long migratory flights of several hundred miles.

In South-Western Australia, although several species of true locusts occur, including a form of the world famous migratory locust, conditions are not favourable to swarm development, and so fortunately only scattered individuals are encountered.

The most important grasshopper in Western Australia is the small plague grasshopper of the drier wheatbelt districts. This species causes serious damage to crops and pastures and reaches its peak in September and October. It does not inhabit the wetter areas of the South-West, but in these districts its place is taken by several other species. One of the commonest is the Australian plague locust which sometimes does very serious damage in the Eastern States. In Western Australia it sometimes invades home gardens and orchards but never assumes true plague numbers.

Another common species frequently found around Perth and often quite troublesome during the summer months in the Lower South-West is the so-called wingless grasshopper. The damage done by this species may sometimes be very severe although outbreaks are usually fairly localised due to the fact that only a small proportion of the grasshoppers ever become winged and so migration can only take place by hopping.

A rather conspicuous member of the group which favours grassy paddocks and swampy situations is the yellow-winged locust. This is one of the larger types and one which may at times be troublesome in various cultivated plots. In the northern portions of the State it forms dense swarms and behaves like a true locust, but in the South-West, although often quite numerous, it does not appear in plague numbers.

One of the largest members of the grasshopper group found in the South-West is the spur-throated locust. Like the yellow-winged locust and the migratory locust, it swarms in the more northern regions of summer rainfall and about 10 years ago did very serious damage to the Carnarvon banana plantations. In the South-West, however, it inhabits overgrown grassy situations and is not of major economic importance.

In addition to the species described, numerous other native grasshoppers may appear in different situations throughout the summer months and cause local damage.

The control measures which have been successfully used against the wheatbelt grasshoppers have proved universally effective against other members of the group and can be applied just as appropriately to home gardens and orchards as they can to wheat farms. Poison bran bait is one of the most universal methods

of combating locusts and grasshoppers, and the following mixture is recommended:—

Bran	25 lb.
10 per cent. Benzene hexachloride dust	1 lb.
Water	2½ gallons

The poison dust should be mixed dry into the bran and sufficient water should be gradually added to produce a moist crumbling mash. The bait should be lightly scattered among the grasshoppers, preferably in the early morning, as maximum feeding usually takes place after the insects have been warmed up by the morning sun.

Some of the new insecticides as spray preparations have been found particularly effective against grasshoppers. Among the most useful are dieldrin and chlordane. DDT, although toxic to hoppers, is not outstanding. Dieldrin has been used effectively to kill grasshoppers at rates as low as one ounce to the acre, and where vegetable gardens and backyard infestations require treatment, a general spraying with 0.1 per cent. dieldrin is recommended. The actual dilution which can be recommended for grasshopper spraying will depend upon the type of concentrate, which is purchased but, where large areas require treatment, ½ pint of 20 per cent. dieldrin should be applied to the acre, and where small areas only need attention a 20 per cent mixture could be broken down at the rate of 1 part to 200 parts of water and a general treatment applied.

It is not uncommon for grasshoppers to invade gardens and orchards from adjacent grass paddocks and waste land. Where this is observed, it is often possible to stop the invasion by heavily spraying a strip of grass across the line of advance. Hoppers passing through this treated area will be killed and the number reaching their destination will be greatly reduced. Dieldrin is toxic to poultry and stock and so where heavy treatments have been applied to grass or pasture, grazing animals should be excluded.

ACETONAEMIA IN DAIRY CATTLE

By P. M. A. HARWOOD, M.R.C.V.S., Veterinary Officer

ACETONAEMIA, more correctly known as ketosis is a metabolic disease. Unlike infectious diseases such as tuberculosis or mastitis, which are caused by microbes, metabolic diseases result from an upset in the normal bodily processes.

In the case of acetonaemia, substances known as ketone bodies appear in the blood stream of affected cows. In turn these ketone bodies may also be transferred to the milk and urine.

The cause of the disease is almost certainly a nutritional disorder. Dairy cows are quite frequently affected and most cases are seen in freshly-calved cows; that is cows that have been milking for from one to six weeks.

HOW THE DISEASE IS CAUSED

In order to understand the disease, it is essential first to understand the normal process of digestion. A cow receives most of its energy from carbohydrates which are starches, fibres and sugars present in pasture grasses, hay, cereals and other foods. The amount of carbohydrate in any food is measured in terms of its starch equivalent which is the amount of carbohydrate in a given food compared to 100 lb. of starch. It is highest in young green pasture grasses and lowest in poor quality dry grass.

Carbohydrates are broken down within the body to carbon dioxide, gas and water, energy being produced in the process. They can be visualised in the role of the fuel that drives an engine.

If the amount of carbohydrates in the food does not provide sufficient energy for the requirement of the cow, body fat is broken down by a similar process to give energy. Normally this takes place in the same manner as carbohydrate digestion, the fat being broken down to yield energy, carbon dioxide gas and water. In this carbohydrates are also required to provide what may be visualised as the draught needed to completely burn the fuel.

If insufficient carbohydrates are being taken with the food, the fat is not completely broken down and a similar condition to a smoking fire exists. Instead of a complete digestion of fat with maximum yield of energy, ketone bodies are formed and become present in the blood stream. These ketone bodies possess poisonous properties and it is this poisonous effect that causes the disease.

From what I have just mentioned about the causes of the disease you can see that it is most likely to occur under two conditions. Firstly it should occur when the feed is of inferior quality and low in starch equivalent, and secondly it should also occur when the cow needs its greatest amount of energy which is in the early part of its lactation. And this is exactly what we find in the field.

Acetonaemia is almost always seen in freshly-calved dairy cows which are high producers and is commonest towards the end of the summer when the feed is at its worst.

TWO FORMS OF ACETONAEMIA

The symptoms of acetonaemia take two forms, the most common one being the digestive type. There is loss of appetite, particularly in regard to concentrates, and a rapid fall in milk yield. The cow stops feeding and appears to be dull and listless. Usually she falls away in condition. The odour of the ketone bodies can often be smelled in the breath as a sweet odour like chloroform. This smell may also be quite strong in the milk. Some people notice it immediately whereas others just cannot pick it up at all.

Another type of acetonaemia known as the nervous form also occurs occasionally. Usually the cow licks incessantly either at herself or at the feeder, other cows grind their teeth, champ their jaws, roll their eyes or even stagger about and fall over. Quiet cows may suddenly become wild. I must stress that this form of the disease is not common and is easily confused with another metabolic disease, grass tetany.

Most cases of acetonaemia cure themselves in time. The affected cow stops milking thereby reducing her energy requirement so she does not have to call on her fat reserves and therefore recovers. However, there is a good deal of economic loss due to loss of milk production and also loss of condition when the cow is not eating. Other cows have recurrent attacks.

It is not often that a cow dies of acetonaemia but she may become so weak and low in condition as to fall an easy prey to other conditions.

When a freshly-calved cow suddenly loses her appetite and goes off her milk, there is good reason to suspect acetonaemia. If, in addition, a sweetish smell can be noticed on the breath and in the milk the diagnosis can be made with a fair degree of certainty. Definite diagnosis, however, can only be made by the use of a simple chemical test which is carried out by the Department of Agriculture. Small samples of about 1 oz. of either milk or urine should be clearly labelled and sent in immediately after collection in tightly-stoppered bottles.

TREATMENT

And now we come to the treatment. Firstly the old methods which treated the disease by giving the cow extra carbohydrates in the form of sugar. Molasses are a good source of sugar and are more effective if chloral hydrate is added.

An ounce of chloral hydrate dissolved in a pint of hot water and a pint of molasses should be given morning and night for two days, followed by ½ oz. of chloral hydrate in the same quantities daily for the next six days.

Quicker in effect are injections of glucose. 8 oz. are dissolved in a pint of boiling water and allowed to cool. When at blood temperature this solution is injected under the skin in several places. The injections may be repeated daily until a cure is effected.

An entirely new line of treatment is with the new wonder drug A.C.T.H. which is available only to veterinarians but now the cost is low enough to make its use well worth while. Most cases recover within one or two days of a single injection.

MOLYBDENUM FOR SUBTERRANEAN CLOVER

By T. C. DUNNE, B.Sc. (Agric.), Ph.D. (Calif.), Chief Plant Nutrition and Research Officer

SUBTERRANEAN clover is undoubtedly the most important pasture species in this State. Because it is a legume, it can make excellent growth on soils with a low nitrogen content. The nitrogen it needs is, of course, provided by bacteria which inhabit the nodules found on its roots. These bacteria provide nitrogen by taking it from the air and converting it to a form which can be used by the clover. However, it is now known that the bacteria can use the nitrogen of the air only if enough molybdenum is available to them.

On molybdenum-deficient areas, therefore, subterranean clover lacks sufficient nitrogen for healthy growth and only pale yellow weak clover plants are to be seen. The possibility of molybdenum deficiency occurring in our pastures is obviously of considerable importance to us.

Since molybdenum deficiency of subterranean clover was first recognised at Donnybrook we have tried to determine how much molybdenum should be applied to deficient areas. There were only two types of molybdenum fertiliser available in this State which warranted consideration—one was roasted molybdenite ore and the other was crude sodium molybdate. Other compounds such as those obtainable from chemists or drug houses are unnecessarily pure and are too expensive for use in agriculture.

The results of our trials have shown that the best growth was obtained from using either 2 oz. per acre of roasted molybdenite or alternatively 6 oz. per acre of crude sodium molybdate. To cater for topdressing with molybdenum, the fertiliser manufacturers now have available a mixture which contains 2 oz. of molybdenite ore per bag of superphosphate.

At Donnybrook, molybdenum deficiency was found to occur on the red and chocolate soils, associated with granite. It was reasonable to expect that it would also occur on similar soils extending North, South and West of Donnybrook. At Bridgetown, Mr. Don Reed on his own initiative laid out a trial which showed benefit from molybdenum. Last season his earlier results were confirmed on his and other farms at Bridgetown and deficiency was also determined in trials on the heavier soils associated with granite at Mullalyup, Nannup, Brunswick Junction and Harvey.

It may be that less serious deficiency also restricts clover growth on some of the gravelly soils—this is being investigated but still remains to be proved.

There are some places where pastures have been deficient in molybdenum for so long that no clover remains. In such cases reseeding will be necessary. Usually, however, the effect of using molybdenum on deficient pastures is a rapid regeneration of subterranean clover. Last year at Mullalyup for example an application of molybdenum increased the clover in the pasture from less than 9 cwt. per acre dry weight to over 27 cwt. per acre. These figures were obtained before growth had ceased and difference in growth would have been greater later on. At one stage treated pastures appeared to be all clover, but actually a satisfactory proportion of grass was present.

A number of last season's experimental areas were grazed after the pasture had matured and dried off. It became obvious that the increased clover content due to molybdenum had greatly increased the palatability of the dry feed. Plots which received molybdenum were grazed bare whereas adjacent untreated plots were scarcely touched.

Some of you have heard of injury to stock caused by molybdenum and wondered if yours were likely to be affected if you used molybdenum fertiliser. Molybdenum can be poisonous—but so can zinc and copper. In England there are pastures where molybdenum occurs naturally in poisonous quantities. In New Zealand on certain areas molybdenum fertiliser has caused trouble. In both countries however danger exists only where the molybdenum content of the pasture is too high.

In Western Australia, we have obtained a number of chemical analyses of treated pasture and in no case has the content of molybdenum in the clover reached a figure anywhere near that needed to cause trouble with grazing animals. When we find exceptions we will let you know.

As far as we can determine at present molybdenum deficiency is not widespread in this State but where it does occur it can be serious because of its effect on the growth and persistence of subterranean clover. It is fortunate that we have the means of overcoming this dificiency both cheaply and quickly.

COBALT DEFICIENCY IN SHEEP AND CATTLE

By C. R. TOOP, B.V.Sc., Chief Veterinary Officer

WITH the establishment of the group settlements at Denmark after the first world war, it was observed that young cattle, although running on lush pastures, developed symptoms of unthriftiness and wasting and usually died. Research conducted by Filmer and Underwood later revealed that this condition was caused by a deficiency of cobalt and that it could be cured and prevented by the addition of this mineral to the diet. Cobalt deficiency has since been met with in other parts of the State and it was recently diagnosed in sheep at Mount Manypeaks.

With cattle and sheep, minute amounts of cobalt are necessary for growth and health. It is required by the microbes which inhabit the first stomach for the synthesis of Vitamin B 12 and other nutrients which are essential for the maintenance of health. Although this requirement is extremely small the intake must be frequent and regular, and animals deprived of cobalt for more than three to four weeks will commence to show signs of unthriftiness.

The daily requirement of cobalt for the sheep is less than a milligram and for cattle it is about 10 milligrams or to put it in another way, one ounce of cobalt chloride will supply the needs of 1,000 sheep or 100 cattle for a week.

The symptoms of cobalt deficiency are progressive weakness, wasting and loss of appetite which virtually cause the animals to starve to death. Affected sheep have a watery discharge from the eyes, there is profound anaemia, the skin is pale and blanched and the wool appears dry and lifeless. Lambs become stunted and unthrifty and cease to grow. Cattle may develop a depraved appetite causing them to eat sticks, dirt and other rubbish and the coat becomes long and rough. Milking cows go dry and may abort or become affected by sterility. Without appropriate treatment death may occur in two or three months from the onset of the symptoms.

Cobalt deficiency may be corrected by top-dressing, the use of licks, drenching or the addition of cobalt salts to the drinking water, but the method employed will depend upon the circumstances.

For top-dressing, the application of cobalt chloride or sulphate incorporated in the superphosphate at the rate of 4 oz. to the acre every second year is recommended. This will make certain that every animal on the property obtains its cobalt requirements.

The use of cobalt as a top-dressing, however, is limited by the added cost and it is only justified on well-improved pastures with a high carrying capacity.

A suitable lick may be prepared by mixing 2 oz. of cobalt chloride or sulphate with 100 lb. of salt and provided it is consumed at the rate of 1 oz. weekly by sheep and 1 to 2 oz. daily by cattle it will prevent cobalt deficiency. Similar results will be obtained with Denmark lick which consists of a mixture of salt, bluestone and limonite which contains cobalt as an impurity. Licks are only satisfactory when consumed regularly and in the required amounts and this is by no means always the case. With dairy cattle the lick may be added in the recommended dosage to the feed.

To prepare a suitable drench, dissolve 1 oz. of cobalt chloride or sulphate in a gallon of rain water. The dose of this solution for sheep is 5 ccs. once weekly or 20 ccs. each fortnight and the equivalent dosage for cattle is 50 ccs. weekly and 200 ccs. fortnightly.

Drenching at weekly intervals will give the best result and once a fortnight will also prove effective. Monthly drenching will not, however, prevent the deficiency.

Because of the frequent mustering and handling involved and the cost of labour, drenching will in most cases be regarded as impracticable. In the case of dairy cattle the drench could be given to calves in their milk or to cows mixed with the feed in the bails.

The addition of cobalt chloride to the drinking water at the rate of an ounce to 7,000 gallons will supply the needs of both sheep and cattle. This method of control, however, is applicable only when the stock are watering from tanks and troughs and cannot be employed on properties with open waters. Furthermore on some deficient areas the water contains carbonates in solution which precipitate the cobalt making it unavailable to the stock when drinking. In addition sheep drink little water when green feed is abundant during the winter and spring and this is a further disadvantage.

The response of affected animals to the administration of cobalt is dramatic and early recovery may be expected even when the symptoms are far advanced.

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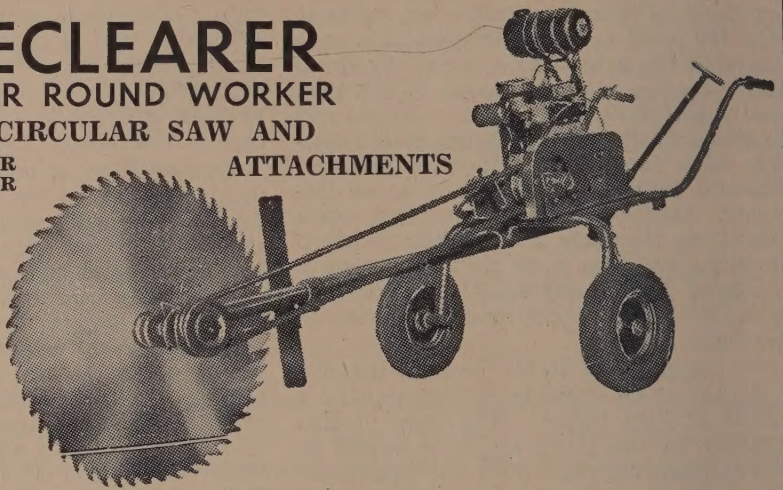

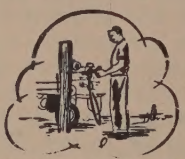

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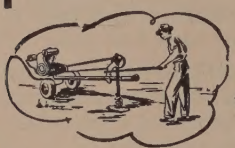

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